THE PRINCIPLES OF TEACHING-METHOD

With Special Reference to Post-Primary Education

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PREFACE

TIMES change and so do attitudes. This is particularly true in relation to the professional training of teachers. That process began in England in humble circumstances—the training of elementary scholars to teach elementary pupils. However, the Training Colleges did their pioneer work remarkably well and established, beyond doubt, the value of professional training in terms of practical efficiency. Later the hall-mark of academic respectability was bestowed upon teacher-training by the foundation of University Departments of Education.

Since 1919, however, the problem of training has increased in scope and difficulty. The improved general education of the potential teacher has vastly increased his possible field of service. A good student in a modern university training department may find his way eventually into any one of a number of posts varying between a small rural elementary school and a university. In addition, post-primary education, while it is being organized more systematically, is at the same time becoming much more specialized. Each branch of the work—senior schools, selective central schools, junior technical schools, grammar schools, and technical high schools—presents its own specific problems. It is undesirable, therefore, to restrict the training exclusively to one type of service.

Hence, the question now being asked is, not whether teachers shall be trained, but what kind of training is most satisfactory. By implication we now have to decide not whether educational theory is desirable, but what kind of theory is most desirable.

It is clear that the quality most necessary in potential teachers is not an ability to use specific tricks of presentation and large-class management suitable for a pre-determined type of school, but power of adapting certain broad principles to a variety of different school-circumstances.

It seems, therefore, that those engaged in teacher-training must present to their students firstly, a comprehensive philosophy of education in which certain fundamental aims of all education are

clearly set forth ; and secondly, a few broad principles of educational psychology upon which all enlightened teaching-methods must be based. Teaching-methods are, after all, only practical applications in specific conditions of educational and psychological principles.

This book is an attempt to meet these needs. In it a philosophy of education is suggested in outline, and certain broad principles of most value for the practical teacher are set forth.

In addition, an attempt has been made to give the treatment a realistic quality. Too many books on teaching-method make professional psychologists feel sick, and professional teachers contemptuous, or at best, mildly amused. The principles herein exposed are such as can be, and have been, substantiated by controlled scientific experiment. No particular psychological view-point has been adopted exclusively, and it is hoped that the student who is sufficiently interested to pursue his studies to more advanced levels will have as little as possible to unlearn. At the same time the needs of the practical teacher have been kept in mind in two ways, first by presenting psychological principles in a form which renders them applicable to the practical work of educating children, and secondly by suggesting how such applications can actually be made.

The treatment of motivation and interest is a case in point. The modern instinct-psychology, an off-shoot of out-moded biological speculation, has, in spite of a superficial attractiveness, little in reality to offer to the practical teacher. It is far too much simplified for his needs. The teacher has to deal, in the classroom, not with instincts as such, but with ideas, attitudes, and habits. Further, in some discussions of interest arising mainly from Herbartian doctrines it seems to have been assumed that children must always be kept in a condition of ecstatic excitement, and if they are not, then the teaching must be poor. It is this particular aspect of the doctrines of interest which has earned the suspicion if not the contempt of many discerning practical teachers and is the real ground for the objections to ' soft pedagogy.' Actually, much of the routine-work of the normal post-primary school, particularly in pursuits which demand a high degree of executive skill, is habitual and monotonous, and cannot be made continuously and ecstatically interesting, even if this condition were desirable.

The really successful teacher, *at the post-primary stage*, is the

one who can keep a class of pupils steadily and happily engaged on monotonous repetitive work at their optimum speed, in such a way that they are not bored and repelled by it. In these cases, boredom, aversion, and complacence are quite as important as positive interest, yet few text-books on educational psychology so much as mention these important human attitudes. In the present work an attempt has been made to generalize contemporary doctrines of motivation and interest and to incorporate the results of modern researches on monotonous repetitive tasks. Thus, a much clearer detailed guidance than is offered by the over-simplified instinct doctrines is made available for practical teachers, and in addition a more accurate psychological point of view is suggested.

Brevity may be the soul of wit, but it is also an economic virtue. To bring the length of the book within reasonable bounds, the discussion has been limited to the problems of the post-primary stage of schooling. This will explain in part the emphasis placed upon systematic intellectual education. Much of the treatment must perforce be somewhat dogmatic, for reasons of space, but as far as possible detailed guidance in specific applications of psychological principles to classroom practice has been included for the benefit of the large number of present-day students who undertake professional training without previous teaching-experience.

Wherever possible explicit reference has been made to sources of experimental data. It is difficult to acknowledge explicitly all the work which has contributed, over a period of years, to the formation of one's present educational views and attitudes. In my own case the work of McDougall, Bartlett, and Spearman is most significant.

The original draft of Chapter IX on Transfer of Training was written in 1935. In 1936 Professor Hamley published a paper in the *British Journal of Educational Psychology* dealing with the problem from a somewhat similar point of view. The same author has contributed an appendix on this topic in the 'Spens' Report. Both these sources I have found helpful.

I wish to thank Professor C. R. Chapple, and my colleagues Dr Gwenan Jones and Mr Ifan ab Owen Edwards for reading and criticising the manuscript. Dr Jones has made valuable suggestions dealing with the linguistic aspects of education and teaching-method, and, in addition, her uncompromising scepticism about some points I took for granted has added materially to the clarity

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A. P.

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SECTION I

INTRODUCTION

CHAPTER I

AIMS IN TEACHING

TEACHING is a practical art, and every good teacher is both artist and craftsman. As is the case in other arts and crafts, the professional teacher employs procedures which have been practised from the earliest times.

Many teachers, even at present, have learned these procedures by imitation, and have perfected a certain degree of skill by repetition in a traditional school-organization. In some cases, aided by native intelligence and an intuitive sympathy with children, untrained teachers have been highly successful. Generally speaking, however, the teacher who owes his skill to traditional practice tends to persist in his tradition and fails to accommodate his methods to changing conditions.

With the great increase in the scope of post-primary education which has occurred since about 1900, goes the need for adjusting methods to new conditions. Further, we must be able not merely to modify methods and organization to suit present-day conditions but also *to devise deliberately, in advance,* systems of organization and methods of teaching calculated to encourage further changes in the general social and economic life of the people in the direction of a happier, more humane, and more civilized community life. For this purpose we need to have a clear realization of certain ultimate aims and permanent values in education, and an explicit appreciation of principles of development and learning as these apply to human beings.

Why Teach?

Teaching is not co-extensive with learning. Pupils learn during the ordinary course of out-of-school life. Also, given an adequate supply of apparatus and books, and opportunities for practical work and study, the abler pupils, particularly in the post-primary period, learn a great deal by individual work in school. What, then, is the use of teaching?

Teaching is necessary because the pupils are relatively immature. They must learn by their own activity, but *their activity needs guidance.* When books were scarce and laboratories non-existent, teachers had even to provide information. That is not so necessary nowadays. But, in using his own activity, the immature pupil may learn subject-matter of little educational value. He may, and usually does, acquire habits of skill that are easy to use at first but relatively inefficient later, such as counting on the fingers. The good teacher knows what subject-matter is most valuable, and he is the custodian of good methods of working. Further, he is relatively expert in his own branches of work and can therefore set good standards of accomplishment for pupils to aim at. Hence, while it is desirable that pupils should learn as far as possible by their own personal activity, the teacher is necessary *to facilitate the learning-process.* If this principle is kept clearly in mind it indicates the relative scope and importance of teacher and pupil activities in school work.

How Teach?

Our next question must be, how can the pupils' learning be facilitated?

Teaching consists of a relatively few fundamental processes already quite familiar to all readers. We have:

PROVIDING EXPERIENCES OF EDUCATIVE VALUE

(*a*) *Directly*, by taking or sending the pupil to places of interest; accumulating and presenting specimens, models, pictures, and apparatus to be used for observation and experiment in school.

(*b*) *Indirectly*, by oral narrative and description; or by accumulating books and referring the pupil to these, when he is able to read, for information.

GUIDANCE

In this we can distinguish several sub-processes :

(*a*) *Demonstration.* Here the teacher provides good models which the pupil may imitate, and which serve at the same time to set a standard of excellence at which he must aim.

(*b*) *Suggestion.* This process will be dealt with later in more detail. For the present we may say that by its use the teacher conveys ideas and directions upon which the pupil may act before he understands their full logical significance.

(*c*) *Discussion.* This may be described as a conversation between teacher and pupils (including question and answer), the purpose of which is to *direct the pupil's attention to the significant factors in experience and activity* so that they may be clearly envisaged, abstracted, and organized into general principles of knowledge, and skill. This process is essential for the transfer of the effects of training.

MOTIVATION

By motivation is meant the process by which the pupil's will-to-work is maintained, particularly in tedious occupations, or in face of difficulties, until success is achieved. In so far as motivation can be accomplished directly by the teacher it is done by suggestion (already noted) and by exhortation. Motivation can be accomplished indirectly by skilful control of the conditions of learning.[1]

TESTING AND EXAMINING

This is accomplished by requiring the pupil to reproduce what has been learned, to answer questions, and solve problems presented to him.

Thus teaching consists of *a few modes of personal inter-communication between teacher and pupil.* The professional teacher uses the same processes as the layman but, in so far as he is competent, he knows how to use them more efficiently. In particular, the skilled teacher can *adapt the teaching-processes to varying conditions and aims.* The relative value of the various modes of teaching depends upon the conditions in which they are used, and the educational aims in view. What, then, are these conditions and aims ?

[1] See later, Chapter V.

Some Conditions to which the Teaching-processes must be adapted

The following are some of the main conditions which must be taken into account in teaching:

DIFFERENCES BETWEEN INDIVIDUAL PUPILS

These include:

Differences in general intelligence which determine the rate of a pupil's progress, and the degree of difficulty of the tasks he can master.

Differences in specific abilities. These will determine a pupil's interests and the kind of work at which he is most likely to succeed.[1]

Differences in health and temperament.

Differences in degree of maturity. The younger pupils are *incompletely developed.* A pupil eleven years old cannot do work which he will be able to accomplish with ease at the age of sixteen or eighteen years.

Differences in local environment and opportunity. Local conditions affect a pupil's interests and his previous education before entering the post-primary school. Conditions of the pupil's home life, such as nutrition, opportunities for exercise and play, access to books, means to travel, opportunities for quiet study, all affect his educational progress and must be taken into account in teaching.

NATURE OF THE SUBJECT-MATTER TAUGHT

At the post-primary stage of schooling it becomes necessary to take account of the intrinsic logical structure of the subject-matter. The reason for this will be clearer when the discussions on discipline in this chapter and in Chapter IX have been mastered. Not only must the teacher be clearly aware of the logical nature of the subject-matter but as many of the pupils as have the necessary intellectual capacity must be made aware of it also. The differences in question will be made clearer as the reader proceeds through the book, and the modifications in presentation needed for each type of subject-matter will be indicated in

[1] See Chapters V and IX for further details.

Chapter XI. Here it will be sufficient to say that we shall need to take account of the following types:

(*a*) Subject-matter mainly descriptive and informational.
(*b*) Subject-matter involving inductive development.
(*c*) Subject-matter involving deductive development.
(*d*) Subject-matter dealing with the experimental investigatory method characteristic of the natural sciences.
(*e*) Subject-matter involving mainly the acquisition of physical and mental skills.
(*f*) Subject-matter involving æsthetic appreciation.

SPECIALIZATION OF SCHOOLS

During the period of primary education, let us say from the age of five till eleven years roughly, all normal pupils can be dealt with adequately in single schools which provide a general preparatory training. After this period the need for some degree of specialization in subject-matter, in view of vocational as well as educational and psychological considerations, indicates a specialization of schools. Thus at the present time post-primary education is carried on in schools of the following types, each with certain distinctive aims and characteristics:

'Secondary' Schools

These include public boarding-schools, grammar schools, and municipal secondary schools, in which pupils remain from about eleven to eighteen years of age. They aim at providing a general education of a more advanced type suitable for pupils who will proceed to universities, to the civil service, and to the learned professions.

Technical Schools

These include more advanced polytechnics and technical colleges, junior technical schools, continuation schools (evening schools and part-time day-continuation schools). This group aims at providing a specialized training directly connected with local industry and commerce. The standard of work may be as high as that in the universities and 'secondary' schools but it is *specialized in the direction of vocational needs.*

'Central,' 'Senior,' or 'Area' Schools

These accept pupils from neighbouring primary elementary schools at the age of about eleven years, and retain them until

they become fourteen or fifteen years old. There are two types—selective, and non-selective. In the former, the pupils are selected by examination from a number of junior departments. In the latter, all the pupils over eleven from junior schools in the area are accepted when they reach the age of admission.

These schools aim at providing a post-primary training which is *still of a general nature, but more practical, and more limited in scope* than that in the 'secondary' schools. At the same time it is usual in schools of this type to introduce a 'bias' in the last year or two years of the course. Such bias is determined by the vocational work in the locality and is usually industrial, commercial, or agricultural.

Senior Departments or 'Higher Tops'

In these, work of the central-school type is carried on, but in a separate department within an elementary school.

In so far as this specialization approaches completion, each type of school will cater for pupils of different ranges of age and ability, and will *pursue a characteristic aim.* For our purpose it is important to note that if the aim of each type of school is to be achieved effectively *the teachers must appreciate such aim clearly and modify methods of teaching and subject-matter accordingly.* This brings us to another important factor in the teaching-process, namely, educational aims.

Educational Aims

It is probable that one of the most serious causes of ineffectiveness in teaching is a lack of clear aims in the teaching-process. What should be our aims in teaching? We can put the question in another way by asking what ought to be the results of teaching. This problem may be approached by considering the place and function of a human individual in an organized society.

It is generally agreed that both happy and successful community life, and a satisfactory degree of individual freedom, can be obtained only within a well-organized society. As a member of such a society each adult individual should fulfil three main functions, namely, that of worker, parent, and citizen.

As *worker,* he contributes his quota to the general economic welfare of the community and gains his own livelihood, thereby supporting himself and his dependants. In modern societies this work may be highly specialized. We need craftsmen, scientific

workers, and artists—the producers. We need executives to plan and organize production and distribution. We need distributors—merchants, shopkeepers, transport workers. Some of this work may be mainly mental, some mainly manual (though it is thoroughly false to make any absolute distinction between the two).

As *parent* our individual must take responsibility for the care of home and children.

As *citizen* he must act in an adequate degree as voter, ratepayer, taxpayer, and in times of emergency be prepared to take part in national defence.

In each social function the individual has certain fundamental needs :

Knowledge—general information, specialized subject-matter.

Skill—manual dexterity, as in writing and using craft tools ; complex mental skill, as in reasoning and judging about matters of social policy, or applying principles of science and organization to practical professional situations.

Attitudes—willingness to work, to co-operate, to persevere in a common policy ; loyalty ; courage.

Discipline—this is a concept about which there has been much confused and ineffective thinking. At the same time it has a fundamental importance in social, moral, and intellectual affairs.

The dictionary meaning of 'to discipline' is 'to bring under control.'

Thus discipline applies to each person in his capacity as a member of a social community. If each one insisted on doing exactly as he pleased at any moment, without reference to the welfare of other members of the community, then organized social life would be impossible. The energies of the social group would be frittered away in internal conflict instead of being used efficiently to serve some common end. Lack of loyalty and clear-sighted self-control among its individual members is one of the most serious defects of the ordinary human social group. Conflict rather than co-operation is characteristic. Training in habits of social co-operation and moral self-control is an essential aspect of a good education.

Hence, in so far as an individual is a member of and servant of the community he must acquire at least a minimum of knowledge, skill, desirable attitudes, and discipline. If he does not acquire this minimum willingly it will be imposed upon him. In this *social* preparation of the pupil, the school, together with other educational

institutions, plays an essential part. *The production of individuals with socially desirable qualities and powers is one main educational aim.*

It is not, however, the only desirable aim. As well as being a member of a community, an individual exists in his own right. He is not passive clay to be stamped into a common social pattern. He is endowed with hereditary potentialities, and these grow, even against the pressure of social forces, into a person—a unique creation. According to his hereditary endowment, each individual has personal appetites, interests, and aspirations which he will strive to satisfy. From this point of view also each person needs knowledge, skill, appropriate attitudes, and self-discipline (both mental and physical).

The need for self-discipline is clear. Unless limbs and brain act in good co-ordination, no high degree of skill is possible. Unless inclinations and aspirations are prevented from conflicting and brought under the control of personal purpose and will, self-development is retarded or prevented altogether.

The development of each individual into a happy, well-co-ordinated personality, into a good human being, is therefore a second educational aim at least equal in importance to the first aim.

These two aims—social adjustment, and harmonious individual development—will determine the relative value of subject-matter, plans of school organization, and teaching-processes. In so far as the aim is social efficiency the knowledge, skill, attitudes, and discipline will appear as factors to be imposed upon the individual. They will appear as impersonal standards and patterns to which he must be drilled and moulded. On the other hand, in so far as personal development is the aim, then knowledge will appear more as food; skill as the means of effective self-expression; good attitudes and discipline as essential conditions for inner harmony which is the foundation of happiness. In this case the individual imposes his own pattern upon his environment. He sets his own standards of taste and skill. He selects his studies according to his interests which will be determined largely by the pressure of his native endowments seeking expression and fulfilment. Regarded in this way *education is a process of release for the pupils' powers.*

Arising out of this second aim is a subsidiary aim of considerable importance, namely, the *re-education of thwarted and badly adjusted personalities.* From this point of view we can think of education as

a process of mental and moral hygiene, a process of great significance in our complex and difficult social and economic conditions.

Influence of Educational Aims on Teaching-method and School-organization

A clearly conceived aim determines a teacher's attitude towards his pupils and his choice of teaching-methods. This can be understood by considering the treatment of two common subjects—English and arithmetic. Suppose the social, utilitarian, vocational aim is uppermost. Then in English we shall be concerned that the pupil may acquire correct pronunciation according to some conventional standard ;[1] ability to read aloud fluently and distinctly ; ability to speak, and write 'composition' grammatically ; ability to spell correctly ; ability to compose a letter properly dated, signed, and addressed.

In arithmetic the main considerations will be acquirement by heart of the standard number-combinations and tables of weights and measures ; knowledge of the standard types of numerical calculations used in commerce and technical processes (adding, subtracting, multiplying, dividing ; fractions, decimals, proportion, percentage) ; habits of writing figures legibly and neatly ; and ability to work with strict regard for numerical accuracy.

It is obvious that the pupil is not born with these desirable abilities. His conduct must be moulded into conformity with the accepted social or technical standards. Moreover, the standards are not primarily of the pupil's own choice and must therefore be 'impressed' upon him in the course of training. Hence, in this case, the initiative lies mainly with the teacher. He provides the models and says, "This is what you must do, and this is how you must do it." Therefore *demonstration, exhortation* (since the pupil is, quite often, not immediately interested in these external and arbitrary activities and standards), and *testing* will be important, and frequently used. The teacher's attitude is necessarily one of active domination and interference during the greater part of the learning-process.

On the other hand, if personal development and release of powers is the primary aim, a very different attitude is required. Now the imposition of arbitrary standards and patterns of activity is of

[1] *E.g.*, the pronunciation of British Broadcasting Corporation announcers or some similar prevailing contemporary fashion.

secondary importance. In fact it may be definitely harmful. They are valuable only in so far as they assist the pupil's powers of expressing what he himself desires to express, in ways which seem appropriate to his inner drives. *Now the initiative lies primarily with the pupil.* He decides what he wishes to express and to do. He must develop according to his own personal endowment, and must impress his own patterns of thought and action upon the environment. Only in this way is any kind of originality and creativeness possible. The teacher must adopt a waiting attitude. He must organize a rich, varied, and stimulating environment but allow the pupil to choose experiences according to his spontaneous interests and tastes. He must note the pupil's spontaneous choices, infer the corresponding interests, and provide more experiences appropriate to the fulfilment of those interests.

There must also be *time and opportunity for quiet undisturbed contemplation* during which the pupil can brood over his experiences, work them in imagination into patterns of thought, feeling, and action, and later express in various ways and through various media the results of these imaginative processes. Only when the pupil finds himself baffled and unable to proceed further should the teacher take a hand in the proceedings, and then by suggestion, demonstration, discussion, and often exhortation to persevere in face of apparent failure, try to remove the causes of frustration and release the temporarily thwarted development.

Thus, in this case, *providing educative experiences* is the most important process, followed up by *guidance* when the child needs it, and *motivation.* Since conformity to arbitrary standards and models is relatively unimportant, testing and examining will now be inappropriate.

In passing we may note how a clear appreciation of the two fundamental educational aims indicates the solution of controversies about the importance of accuracy and the necessity for marking. If the primary aim is to teach commercial or technical arithmetic, then accuracy of working is essential. Without it the arithmetic is useless. On the other hand if we are using arithmetical problems as a *means* of exercising, and thereby encouraging the development of the pupil's powers of dealing with certain types of logical analysis, then the ingenuity and elegance of the solution are the essential results. An error in the arithmetical computation is relatively unimportant. Used by itself the term 'accuracy' is ambiguous. It may mean accuracy of computation, or accuracy of logical analysis. Which meaning is significant depends upon the educational aim in view.

Over-emphasis of the Social-economic Aim

In theory, schools are supposed to cater for both these aims, social and personal. In practice, however, the pressure of economic necessity has over-emphasized the social aim at the expense of the personal. The 'secondary' schools have concentrated upon mental skills and a linguistic-mathematical mental discipline of the kind required by university scholars for research purposes. The 'central' and 'senior' schools have shown much too ready a tendency to copy the 'secondary' schools, irrespective of the fact that most of their pupils will never enter a university institution, and are unfitted by lack of special abilities for the professional scholar's pursuits. Also, the secondary schools have had their curricula and teaching-methods determined unduly by academic examinations of the matriculation type.

Technical schools, again, have shown a tendency to concentrate unduly upon specialized knowledge and skill directed towards narrow vocational aims. They have neglected, from time to time, the *general* education of their younger pupils, and have *failed to relate their specific curricula and disciplines to the needs of the community as a whole.*

A false distinction between mental and manual work has marred the conduct of schools of the 'secondary' type. They have, ostensibly, set out with the aim of providing a humane, liberal education, an education, that is, which gives due emphasis to individual self-development. Owing to the importance ascribed to mental work in distinction from practical manual work, these schools have concentrated upon a mathematical-linguistic training calculated to provide a discipline for the so-called mental 'faculties.' Consequently, their curricula have been, in too many cases, more or less completely divorced from the everyday practical life of the majority of their pupils. In the first place, the distinction between mental and manual work is unsound. All conscious human activity involves both mental and manual factors. In fact the skilled workman engaged upon a piece of constructive craftsmanship has to exercise a good deal more observation, judgment, taste, and intelligence than the secondary-school pupil uses in memorizing mathematical formulæ and rules of grammar. In the second place no education can be truly liberal unless the pupil is spontaneously interested and works with zest. Now many pupils are gifted with constructive practical and artistic aptitudes which can find full expression and satisfaction only in corresponding activities. Hence *for some pupils* a well-designed practical curriculum is a better medium for their liberal education than a theoretical mathematical-linguistic curriculum. This principle is being recognized with

increasing clearness in the central and senior schools. It needs to be recognized also in dealing with the 'B' and 'C' forms of secondary schools.

On account of the tendency we have mentioned, to over-emphasize the economic and social aims of the educative process at the expense of personal development, there has been a movement in recent educational thought and practice towards an opposite extreme, namely, that personal self-expression is the only factor that matters. This fashion in thinking is revealed by the opposition to drill, to time-tables, in fact to any kind of limitation whatever upon the individual's personal whims.

This latter attitude seems to be quite as irrational and dangerous as its opposite, and implies a misconception of the nature and function of discipline. The fact is, that discipline is essential *even for successful self-expression.* Each art, whether it be painting, cabinet-making, playing a musical instrument, or solving problems by means of the calculus, has a characteristic form. Success at the art implies that the native components of the skilled habits involved have been *shaped* (*i.e.*, brought under control, or disciplined) in accordance with the requirements of the materials and the tools which are the media for the self-expression. Each art imposes its characteristic discipline upon the performer. Hence if we wish to achieve any worth-while self-expression we must be prepared to accept the conditions the art imposes, *i.e.*, submit to the necessary discipline. Thus the true alternative to externally imposed standards of conventional vocational or social subject-matter is not absence of all imposed standards, but proved standards implied by the art in question *willingly accepted* by the learner. This is a most important distinction.

It will be found that a clear conception of discipline indicates the correct answer to that rather hoary controversy about the relative importance of imitation and creation (or originality). First-class creation is impossible without discipline and discipline implies at least a minimum of imitation—imitation, that is, of the skilled processes which have been found by repeated trial to produce efficient results. The first-class creative artist or craftsman is found, almost invariably, to have spent much time in acquiring the skilled habits of his craft.

The Conditions of Everyday Teaching—A Warning to Novices

In conclusion, a word of warning is indicated for the benefit of readers whose actual experience of school-conditions is limited.

Teaching processes must be adapted to the reality of local conditions. Books on principles of teaching-method are apt to leave the impression that when the student-in-training secures his first appointment he will deal with perfect pupils who behave exactly according to the text-book rules, in ideal schools in which there is apparatus for every emergency, perfect freedom to conduct experiments, and unlimited time to follow out every theoretical suggestion.

Only too often school-conditions are the reverse of perfect. This discovery comes as a shock to the enthusiastic but inexperienced beginner, who thereupon is tempted to conclude that since his theoretical instruction is not immediately and fully applicable, it is therefore useless. This revulsion, though understandable, is unfortunate and unnecessary, and it may be prevented by a clear realization of some of the more important practical conditions in which theoretical principles must be applied. These are :

1. In the case of all but the wealthy, vocational needs must influence what pupils are taught and at what period they shall learn it. The domination of the schools, both junior and post-primary, by the examination system is due largely to economic factors. Parents, anxious for the material welfare of their children, bring continuous pressure, direct and indirect, to bear upon the schools in the direction of successful preparation for examinations. Therefore syllabuses are moulded, and teaching-methods modified to meet examination requirements, although theoretical educational and psychological principles indicate more satisfactory procedures. One unfortunate result of this pressure is the introduction of utilitarian elements into school-syllabuses long before the pupils are mature enough to appreciate their significance and master the work involved.

2. Many school-buildings are hopelessly out-of-date. Some, indeed, are scarcely fit for human habitation.

In addition, classes may be large and badly graded ; apparatus, books, and writing-material meagre in quantity ; and the educational life of the pupils short.

These material conditions impose serious limitations on a teacher's educational activities. This, of course, is not a plea in defence of conditions which prevail in many areas. It is only a warning that such conditions exist. It is not practicable to remove the conditions immediately and some teachers will have to endure them.

3. The pupils themselves present difficulties. They vary tremendously in ability and temperament. Many are unwisely treated at home and transfer their dislike of parents to the teachers. They often show far more interest in out-of-school activities than in what the teacher is required by his authorities to teach. In fact, most individual pupils in real life are very much different from the text-book picture of the 'average' child.

4. Our educational system (even in some aspects of elementary education) is the product of centuries of tradition; the teaching profession conservative and, it must be confessed, timid. Head-teachers and senior colleagues do not always welcome the junior teacher's enthusiasms and projects for reform. To welcome these is equivalent to condemning their own methods and that process is seldom popular. The new recruit may find that he is positively forbidden to make any experiments at all, even so slight as small changes in the order of a syllabus, or presentation of a particular subject. Such changes might interfere with the next examination results, a calamity too dire to be contemplated with equanimity.

5. Finally, the teacher may find difficulties in his own temperament. A timorous or easy-going disposition will prevent him from making changes which his reasoning indicates to be sound and desirable.

Hence, every practical teacher is faced, sooner or later, by two alternatives—how *ought* one to teach, and how *must* one teach. The answer to the first question is indicated by theoretical principles of teaching-method in conjunction with a considered and critical philosophy of education, its aims and values. The answer to the second question is determined by the material conditions in which practical teaching is carried on. The function of the good teacher is to reconcile these two aspects—theoretical and practical. What we must *not* do is accept the conditions as irrevocable and then conclude that theoretical principles are useless because they cannot be applied completely.

Exercises

1. Compare the conditions of a large well-equipped town school and a small rural school in out-of-date buildings. By observation of two such schools find out what differences in teaching-methods, syllabuses of work, and organization of classes are imposed upon the staffs.

2. Write down a list of teaching devices which are necessary for *class* teaching with groups of thirty to forty pupils. State what functions are served by each. Then write down a list of devices necessary for organizing *individual work*, (*a*) dealing with one or two pupils only, and (*b*) dealing with thirty pupils. Again state what functions are served by each device. Compare the two lists.

3. Name as many different plans of school-organization as you can. State what difference in teaching-methods each makes necessary.

4. What differences in teaching-methods seem to be indicated for teaching adults as against junior-school pupils?

5. Discuss critically the assertion that it is absolutely essential to insist upon correct grammar and spelling in all language exercises.

Books for Further Reference

ADAMSON, J. E.: *The Individual and the Environment.*
BAGLEY: *Educational Values.*
BODE: *Modern Educational Theories.*
JACKS: *Education of the Whole Man.*
RICHMOND: *Education for Liberty.*
,, *Permanent Values in Education.*
O'SHEA: *Education as Adjustment.*
TABA: *The Dynamics of Education.*
THOMSON: *A Modern Philosophy of Education.*
WHITEHEAD: *The Aims of Education.*
DEWEY: *Democracy and Education.*
MASON: *An Essay towards a Philosophy of Education.*
ALDOUS HUXLEY: *Ends and Means* (Chapter XII).
NORWOOD: *The English Tradition in Education.*
NUNN: *Education, Its Data and First Principles.*
SHAW: "Parents and Children" (Preface to *Misalliance*).
WELLS: *Joan and Peter.*
MACMUNN: *The Child's Path to Freedom.*

CHAPTER II

SOME GENERAL PRINCIPLES OF LEARNING AND DEVELOPMENT

What is Learning?

If the purpose of teaching is to facilitate learning, we cannot do better than begin by asking what is learning, and what conditions affect it.

To many people the answer seems so obvious as to make the question superfluous. They identify learning with the process of accumulating information. This, however, represents a very dangerous half-truth. Learning includes much more than the mere acquisition of information.

Let us consider the problem from the more general point of view of behaviour. We can think of all behaviour as conforming to one comprehensive pattern. First, some sense-organ is stimulated with sufficient intensity. Then the stimulation is followed by a response. The stimulus may come from outside the body of the learner, or it may arise internally. The response is usually complex, and it may include any or all of the following aspects:

Movement of muscles.
Secretion by glands, *e.g.*, tears and saliva.
Feelings, *e.g.*, pleasure, annoyance, surprise, elation, depression.
Emotions, *e.g.*, anger, fear.
Sensory perceptions.
Recognition of objects and memories of previous experiences.
Ideas.
Moods, *e.g.*, satisfaction, complacence, melancholy, optimism, pessimism.
Attitudes, *e.g.*, agreement, conviction, doubt.

Usually both stimulus and response are complex.

Observation of human and animal behaviour indicates that we can distinguish between two sub-groups of stimulus-response patterns. In the one, the responses remain relatively unchanged

throughout life. This group includes the movements of the involuntary organs—heart, lungs, stomach—and the secretion of glands. In the other group we find skeletal muscular movements, sensory perceptions, ideas, moods, and attitudes. These responses begin to change immediately after birth and keep on changing with varying rapidity throughout life.

Actually *we detect learning by the fact that a response has been modified*, and we measure the degree and rate of learning by the degree and rate of modification. We can conclude that learning takes place whenever any response is modified, and conversely that in the absence of any modification there is no learning.

Learning is a process of development and we can define it as *a process of development which results in the modification of response.* The modifications are not always positive, and they need not be immediate.[1] After a child has burned his finger by touching a hot cinder, the next time he sees a similar cinder he will refrain from touching it. This is a negative modification (or inhibition). A person may have a Conservative attitude in politics. After listening to many arguments and counter-arguments, reading books, and thinking over the matter he may adopt, after the lapse of a considerable time, a Liberal attitude. This is an example of a delayed modification.

Thus the acquisition of information is only a part, indeed only a small part, of learning. To identify the whole of learning with accumulating information is most dangerous for the intelligent understanding of education. The full implications of this wider view of learning will become clearer as we deal with psychological topics in more detail.

Modes and Levels of Learning

For educational purposes it is useful to distinguish between different *modes* and *levels* of learning.

MODES OF LEARNING

Sensory-motor Learning

Many stimulus-response patterns of behaviour are ready for use at birth. Thus the baby sneezes if his nostrils are tickled, pulls away his foot if it is pinched or pricked, clenches his fist if an object is placed on his palm, gasps if lowered quickly. These

[1] We are taking for granted that learning does not include modifications of response due to accidental injury or disease.

ready-for-use behaviour-patterns are called reflexes. Sensory-motor learning consists in the modification of reflex actions (*a*) by changes in the situations which effectively stimulate the sense organs; and (*b*) by changes in the movement response which follows the stimulus.

Examples are (*a*) a child first obeys an instruction when he hears the words spoken, and later obeys the same instruction when he reads the printed words; (*b*) a child reaches out his arm and touches a hot cinder, then later refuses to touch a similar cinder.

Ideational Learning

In this mode, responses are modified through the re-organization of ideas. Having obtained ideas through observation and experiment, the learner can compare and contrast them *mentally*, analyse and re-organize them by virtue of a capacity for recognizing logical relations, and apply in practice the results of his thinking.

LEVELS OF LEARNING

It is very important, in view of discussions which will follow later, to distinguish two different 'levels' at which both sensory-motor and ideational learning can take place.

Learning may be *unwitting*, *i.e.*, the process is not explicitly recognized by the learner as having taken place. Mannerisms and prejudices are learned in this way.

It may also be *critical* and *deliberate*. In this case the learner not only modifies his responses but seeks to do so, realizes what he is doing, and recognizes the purpose for which the modification is intended.

Unwitting Learning

Unwitting learning is the result of environmental influence upon the learner which operates through the process known as conditioning responses. This process has been studied extensively in recent years, and since the results of this unwitting learning are so very important in fashioning attitudes, beliefs, and social conduct it is essential that teachers should be aware of it. Teachers themselves can, without being aware of what they are doing, condition the responses of their pupils in ways which may be undesirable from an educational point of view. For this reason it is worth while considering the process in more detail.

Conditioned responses were first noted explicitly by a Russian physiologist, Pavlov.

He discovered that if dogs were fed regularly a few seconds *after* a bell was rung, then after several repetitions of the bell-followed-by-food stimulus the dog secreted saliva *when the bell alone was rung*. The secretion of saliva at the touch and taste of food in the mouth is the primitive or unconditioned response. The secretion when the bell is rung is the conditioned response.

Conditioned responses have been studied in human beings. J. B. Watson, an American psychologist conditioned the fear responses of a young baby.

Albert, the baby in question, showed no fear whatever of rats, rabbits, and pigeons, and played with them with evident pleasure. In the conditioning experiment he was presented with a white rat, but just as he put out his hand to touch it, a bar of iron was struck with a hammer behind him. He had previously showed signs of fear at this noise, and instead of touching the rat as usual, he hesitated. After several repetitions of the rat-followed-by-noise stimulus he transferred the fear of the noise to the rat, and on being shown the rat he cried vigorously and scurried away in obvious terror.[1]

In another experiment it was shown that a fear-response could be re-conditioned. Three-year-old Peter was mortally afraid of a rabbit but he thoroughly enjoyed a meal of milk and biscuits. He was seated at one end of a long table and given his milk and biscuits which he attacked with the usual pleasure. At the same time a rabbit in a cage was placed at the other end of the table. The rabbit damped his enjoyment somewhat but did not prevent him from completing his meal. Each time he had his milk and biscuits, the rabbit was brought out and placed a little nearer to him. Gradually he transferred his enjoyment of his food to the rabbit, and finally petted the rabbit quite unconcernedly while drinking the milk. Thus his fear of the rabbit was re-conditioned.

This conditioning process continues throughout life. As a result, beliefs, prejudices, attitudes of which the possessor may be quite unaware are acquired by contact with a particular local environment. Such learning may be useful in so far as it establishes a minimum of essential social habits of conduct and thought. At the same time it may be very harmful from an educational point of view, since the habits acquired are not under the critical control of the learner. He does not realize he has them, and they may, and frequently do, hamper the full development of a well-balanced personality.

Imitation and suggestion often lead to unwitting learning but need not do so necessarily. Actions may be copied, and suggested

[1] *Psychologies of* 1925, p. 52.

ideas adopted deliberately, after intelligent consideration. We shall see, later, that one of the most important educative functions of the teacher is to raise the pupil's learning from the unwitting level to that of conscious deliberation.

Deliberate Learning

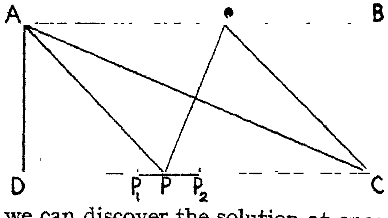
At a higher level of learning, we become conscious of some problem or difficulty, either practical or theoretical, and we set out deliberately to solve it. We can do this in two ways, either by *trial and error* or by *logical analysis*.

As the name implies, trial-and-error learning occurs when we realize that there is a problem but do not know exactly how to solve it. We try one way, and if that does not succeed we try another, and continue to vary our methods until we have found some sort of solution or give up in despair. It is a clumsy, primitive procedure, wasteful of both time and energy. Therefore, whenever possible, we substitute for it the process of logical analysis.

In analytic learning we analyse the complex difficulty into simpler factors and endeavour to discover exactly where the problem lies. Then we apply some general principle which indicates the correct solution.

Geometry provides many examples of the difference between trial and error and analytic learning. Here is a simple case. Suppose $ABCD$ is a rectangular sheet of glass and we are required to make from it a rhombus using two cuts only from A and C respectively.

We know that in the rhombus all the sides must be equal in length. We can begin by guessing at a point P_1 in DC, measuring AP_1 and comparing it with P_1C. If the first guess is wrong, we can make others, *e.g.*, at P_2 and repeat the measurements until we have hit upon the correct position for the point P and (in a similar way) the point Q.



However, by analysing the problem and applying a general principle we can discover the solution at once. The diagonals of all rhombi bisect each other at right angles. Therefore the required point P must be at the end of a diagonal which bisects AC at right angles. If we draw AC and then a line bisecting it at right angles, the intersections of the latter with DC and AB will locate the corners of a rhombus, namely, $APCQ$.

One great advantage of the analytic process is that not only do we get straightway to a solution but we can demonstrate that

the solution is correct. Hence, it is desirable to make the pupil's learning not only deliberate, but analytic, to the highest degree of which he is capable.

SOME CONDITIONS WHICH AFFECT THE COURSE OF LEARNING

If learning is one aspect of human development it is desirable that we consider what conditions affect it, since the teacher's function is to facilitate the development in the best possible way.

Some of the changes in response which constitute learning must be due to environmental influence. This is evident when we consider the differences in opinion and attitude caused by imitation, suggestion, and the use of political and other forms of propaganda. If environmental influences did not affect learning there would be no point in teaching, since the school and the teacher are just two factors among many others in the pupils' environment.

Some thinkers have tried to prove that environment *alone* affects the course of learning.[1] This position is altogether too simple to be correct. Children of different parents reared in the same environment (boarding-school, or poor-law institution for example) show marked differences in interests, tastes, attitudes, and intelligence. In particular, if children of varying intelligence are given the same kind and amount of training, the differences between them in educational attainment are increased rather than decreased by the training. Observation indicates that no amount of teaching, however competent, will make mentally defective pupils into first-rate scholars even if other environmental influences —feeding, rest, exercise, housing—are similar.[2]

It is now generally agreed by competent authorities that both hereditary and environmental influences affect the course of development, including learning. Heredity determines what kind of an individual will develop, and what upper limits the development can eventually reach. On the other hand, the environment accelerates, or retards, the rate of development and determines whether or not full development will actually be reached.[3]

[1] See, for example, Herbart's repudiation of mental faculties, *Science of Education* (Introduction) p. 32 and Watson's repudiation of instincts, *Psychologies of 1925*, Chapter I.

[2] Cf. *Report on Psychological Tests of Educable Capacity*, pp. 74–75.

[3] See Jennings, *The Biological Basis of Human Nature*, for a more detailed discussion of relative influences of heredity and environment on development.

RELATIVE IMPORTANCE OF MATURATION AND TRAINING

Human development is due to a continuous interaction between hereditary and environmental influences. Neither is fruitful without the other. However, from the point of view of teaching it is most important to recognize that *environmental influence is not equally powerful at all times.* There are periods when a given amount of training and practice produce very rapid gains in learning.

The development of walking and talking are cases in point.

At some time between twelve and eighteen months of age the normal human baby will begin to walk spontaneously. Attempts to hasten the onset of walking by holding the baby on his feet and propelling him forward produce negligible results until the baby is ready to walk. Then the child attempts to stand erect, shows interest in the process of walking, and practises *on his own initiative.* At this critical period very little practice seems to produce very rapid progress. Further, the ability to walk well is achieved by normal children in a few months—and thereafter even the constant repetition of the movements of walking produces little if any further improvement in the skill.

A similar course of development is observable in the case of talking. Parents and relatives talk to a baby very frequently. It is encouraged to say this or that word long before there is any accurate response. The net result of several months of such activity is that the child is able to say a few common words very imperfectly until about fifteen to eighteen months of age. After this age progress in speaking improves for some months, but still comparatively slowly until some time usually between two and three years. Then, in a few weeks only, many children acquire a vocabulary and a facility for speaking at an astonishing rate. What is more striking, is, that the child at this period is *strongly interested in* the act of speaking and in new words. He goes around listening for and spontaneously repeating new speech-forms. One can hear children at this period repeating words in a whisper to themselves, apparently for the sake of saying them. Here again, it seems that teaching and practice are singularly ineffective *until the child is ripe (or mature enough) for the exercise.* Then teaching and practice seem just as effective as previously they were useless. Also, after this 'formative' period has passed, the effects of training get smaller and smaller until pronunciation and flexibility of speech remain stable and the vocabulary shows very little further increase. Even if the young child becomes a professional student and reads steadily throughout adult life, it is doubtful whether he ever learns new words so rapidly and easily as in this early formative period.

Similar results have been noted on more complex levels of learning. In the Danish Folk High Schools young people from

eighteen to twenty-five years of age are given courses of general education lasting for about five months. The majority come without any other schooling than that received in the ordinary national or private elementary schools and which finished at the age of fourteen. Experience, however, proves that the same amount of information which it takes the half-grown youth—dozing on the school forms—three to five years to learn, can be acquired by adults, who are keen on learning and who have done practical work, in the space of three to five months.[1]

How can these periods of intense interest and rapid spurts in learning be accounted for? Some insight into this problem is given by experiments reported by C. Bühler.

> Attempts were made to standardize performance tests of intelligence for quite young children. Such tests were given to Albanian babies who "are so bandaged in their cradles during the first year of life that they can move neither hand nor foot. When first unbound, they are unable to hold anything, and yet *within a period of two hours* they cover all those steps for which our children require many months, and finally are able to perform the characteristic tests for their age."[2]

This evidence suggests that inborn aptitudes, in addition to normal exercise, are factors in successful performance of the tests, and that these aptitudes mature or ripen independently of exercise. It is not to be supposed that exercise has no effect. Bühler states that these Albanian babies carry out their first movements with much more clumsiness and hesitation than do children who have had normal freedom to move. The experiments seem to indicate that the degree of maturity of the aptitude determines the *level* of ability possible at any given age, while practice perfects the ability at that level.

This being so, it would seem that the periods of very rapid learning of which examples have been given, are due to the fact that *some corresponding aptitude is approaching maturity during that period.*[3]

It appears that in the interaction between environment and heredity, at certain periods the hereditary aptitudes, when

[1] *The Folk High Schools of Denmark*, p. 136.

[2] C. Buhler, *From Birth to Maturity*, p. 85.

[3] Further corroborative evidence for this assumption has been given by comparing the actual behaviour of people and animals with the growth of their brains and nervous systems at corresponding periods. New movement patterns are found to depend upon corresponding developments in the nervous system. See Coghill, *Anatomy and the Problem of Behaviour.*

approaching maturity, take the initiative and require appropriate expression. They determine the interests of the growing organism at that period and *dictate the lines along which exercise and training will be most fruitful.*[1] Thus the concept of education as a means of providing release for the pupils' powers takes on a very significant meaning.

This relation between maturation and ability raises an important problem for teachers and educational administrators. It follows at once that, if teaching and training are to produce their fullest effect, *the work the pupils are required to do must be adjusted to their degree of maturity.* Not only is such adjustment necessary if the training is to produce its maximum effect, but also because of the results in motivation and interest. We shall see later that success and the conditions in which it is obtained are powerful factors in motivation and interest. If a child is given work to do which is beyond his present powers, success is impossible. Consequently he is confused and frustrated. Feelings of humiliation follow, and the child is apt to acquire fears and aversions with respect to the work, and in some cases a permanent distaste for further education is produced. On the other hand if a child succeeds too easily at tasks which are too simple for his present degree of maturity he despises the work as being something not worthy of his effort. To such a child, schools are places where one is expected to waste time on frivolous trivialities instead of doing real work.

Hence, for enlightened teaching and school-organization, it is necessary that we discover at what periods during a child's development certain aptitudes mature. Further, we need to find whether all of a child's aptitudes exist at the same level of maturity at any given period, or whether various aptitudes develop at different rates and arrive at maturity at different periods. This problem will now be considered.

PHASES OF DEVELOPMENT

Educators have for many years realized more or less clearly the significance of this fact of development in relation to the choice of syllabuses of work, and methods of school-organization. Consequently there have been several attempts to discover what is the actual course of development in normal children.

[1] *Cf.* the rapid changes in adolescence which accompany the ripening of the sex-functions.

One such attempt was the doctrine of faculties. It was supposed that mental and physical powers depended on the ripening of faculties. Thus the faculties of sensory perception and memory were supposed to ripen relatively early, while the faculties of reasoning and will did not mature until early adolescence.

Some thinkers attempted to show that mental evolution in the human individual recapitulated the main phases of the evolution of the race, and in the same order.[1] Others supposed that the intellectual development of each pupil passed through the same phases as did the intellectual development of civilization during historical times (Culture-epoch theory).[2] Perhaps the latest variant of this group of theories is that suggested by Piaget, a Swiss psychologist, who claims to have proved that mental development is determined by changing instincts.[3]

All these theories of development suffer from the same defects. They attempt to provide a simple answer to a question which does not admit of a simple solution. They all take for granted that the aptitudes exist at approximately the same level of maturity at any given time, and that when a change occurs it does so abruptly. These assumptions are all contradicted by more recent and more detailed investigations.[4]

More accurate recent studies of both physical and mental development support the following principles:

Different aptitudes in the same person develop at widely different rates, and reach maturity at different periods.

The general course of development as a whole is a resultant of a large number of different but correlated factors.

There are no abrupt changes from one phase to the next.

There are distinguishable phases of development, each of which owes its main characteristics to the aptitudes maturing during that phase.

Thus, if we consider the case of a normally developed ten-year-old child and construct a table representing the degrees of

[1] See F. E. Bolton, *Principles of Education*, Chapters IV, V, VI, for a discussion of Recapitulation theories.

[2] See Zinser, *Ufer's Introduction to Herbart*, Parts III and IV; Lange, *Apperception*, Part II; Spencer, *Essays on Education* (Everyman Edn.), pp. 60, 61; Monroe, *Text-book of History of Education*, p. 635.

[3] Piaget, *Language and Thought of a Child*, and *Judgment and Reasoning in the Child*.

[4] See Mead, *Handbook of Child Psychology*, Chapter 24; McCarthy, *Language Development—Handbook of Child Psychology*, 2nd Edition (1933); Isaacs, *Intellectual Growth in Young Children*.

maturity of different aptitudes and functions estimated as fractions of full adult maturity we get something like the following :

Functions in which the child is nearly or quite equal to an adult :

Physiological activities of the involuntary organs—digestion, respiration, circulation.
Large-muscle co-ordinations—running, skipping, balancing.
Acuity of hearing and touch.
Rote memory.
Visual imagination.

Functions only moderately well developed :

Speed of movement.
Strength and endurance.
Manual dexterity—finer muscle co-ordinations in specialized muscle systems, such as those involved in writing and using small tools.
Visual acuity.

Functions only very partially developed :

Voluntary concentration and direction of attention.
Voluntary control of movement as in standing or sitting quite still for a period of time.
Comprehension, *i.e.*, the ability to hold together mentally and contemplate several ideas at the same time.
Apprehension and abstraction of logical relations, such as are involved in formal reasoning.[1]

RHYTHMS OF GENERAL DEVELOPMENT

From the point of view of teaching, and of physical and mental hygiene, it is well to consider human development as a whole in terms of *rhythms* of more rapid and slower progress. The development seems to consist of alternating 'springing-up' and 'filling-out' periods.[2]

Two major springing-up periods in physical development show clearly—the first just before birth, the second at puberty. It is said that during the month immediately preceding birth, the human fœtus adds 1 per cent. of its existing weight per day. If this rate were maintained the average baby would weigh 200 lb.

[1] An excellent summary of modern views on the course of development may be found in the *Report on the Primary School*. This should be consulted by all teachers.

[2] See *Report on the Primary School*, Appendix II, p. 222.

at the end of one year, and at the end of twenty years the adult would be as big as the earth!

Superimposed upon these major alternations are one or two minor phases, and the general course of development may be represented by the following table (taking average ages):

Period	Springing-up	Filling-out
First . .	Birth to 1 year	1 to 5 years
Second . .	5 to 7 years	7 to 11 or 12 years
Third . .	11 or 12 to 14 or 15 years	14 or 15 years onward

This rhythmic alternation of faster and slower rates fits roughly over the scheme of developmental stages usually accepted for school and general purposes. The latter scheme goes somewhat as follows:

Babyhood, 0 to 1 year.
Infancy, 1 to 5 years.
Infant-school age, 5 to 7 or 8 years.
Junior-school age, 7 or 8 to 11+ years.
Senior or secondary-school age, 11+ to 14, 16, or 18 years.

Mental progress also appears to follow a similar rhythmic pattern. Between 2 and 5 years most children make rapid progress in talking. They learn new words, particularly names, more rapidly than at any other period. They are very interested in the objects of their environment. Some intelligent children at this period seem to spend their waking life in a continuous and joyous adventure in learning. Their conversations with adults are just series of questions, of the types: What is? How much? How far? How big? How many? and Why? . . .

In the adolescent period the ability to abstract relations, and to reason, which has grown slowly from early years, develops more quickly and we find intelligent children at that period making rapid advances in logical theoretical studies. They enjoy problem-solving and begin to speculate about philosophical theories.

It is noteworthy that the *periods of most rapid mental development tend to coincide with the periods of slower physical growth.*

In the first filling-out period, 1 to 5 years, we have the acquisition of walking; balancing, and general improvement in muscular control; talking; and perceptual experience. In the second filling-out period, 7 to 11 years, powers of perceptual discrimination mature, with

further advance in muscular control and emotional stability. The post-pubertal period, from 14 onward, often shows a further rapid intellectual development, particularly in the apprehension and use of abstract logical ideas.

Many observers have pointed out that the springing-up periods, 5 to 7 years, and 11 or 12 to 14 or 15 years, reveal a temporary falling off in the *rate* of mental progress. *The human organism seems to act as a whole.* It cannot deal successfully with both rapid physical and mental progress at the same time. Any spurt in physical growth drains away energy from mental growth, and *vice versa.* Hence during the years from 5 to 7, and 11 to 14 or 15, *over*-insistence upon *mental* activity in children who are growing rapidly physically, should be avoided. Incidentally we may note that if the majority of children leave school at fourteen years, they pass out of the influence of organized educational work just at the time when they seem most likely to reap the greatest advantage from it.

Predominant Characteristics of the Main Phases of Development

If the school-organization, curriculum, and choice of teaching-methods is to conform with the natural conditions of development in learning, we must take account of the predominant characteristics of that phase of development which will be reached by the majority of pupils in a given department of the school.

Modern school-practice is tending to stabilize the following types of schools (or school departments) :

Nursery Schools—pupils 2+ to 5+ years of age.
Infant Schools—pupils 5+ to 7+ years of age.
Junior Schools—pupils 7+ to 11+ years of age.
Post-Primary Schools—pupils above 11+ years of age.
- (*a*) Senior Elementary Schools, 11+ to 15 years of age.
- (*b*) Secondary and Technical Schools, 11+ to 18+ years of age:

Thus we get four main sub-divisions of the school course and these correspond with distinguishable phases in development (*cf.* p. 37 above). Each type of school or department needs its own characteristic curriculum, organization, and choice of teaching-methods.

We have seen that any ‘ cross-section ’ of a pupil's development at a given age will include many distinguishable functions at

markedly different levels of maturity. Each of the phases 2+ to 5+; 5+ to 7+, etc., will derive its special characteristics from those functions which are approaching full maturity between the ages specified. By catering more particularly for these, the school-organization will bring its influence to bear upon the pupils just at the times when the hereditary aptitudes are most likely to respond most readily to teaching and training.

In reading the following paragraphs we should bear in mind that:

The age-limits assigned are approximate averages, and do not apply absolutely to any given pupil.

There are no abrupt transitions between one phase and another.

Chronological age (*i.e.*, birthday age) is not an accurate index of physical or mental maturity. Careful measurements have revealed very wide differences in rates of development as between one individual and another. One child of 10 years may be equal in height, weight, and strength to the average 12-year-old standard. Another child of the same age may have developed no farther than the average 8-year-old standard. The same is true of mental functions. In grading pupils therefore we need to estimate their *mental* or *physiological* ages, *i.e.*, the extent to which they compare with the average degree of development reached by a large unselected population of children of a given chronological age.

Of the phases indicated above, two (5+ to 7+, and 11+ to 14+) show rapid physical development and a corresponding temporary falling-off in *rate* of mental development. Both are phases of instability, during which there may be abnormal liability to certain types of disease and emotional disturbance. Some pupils during these two phases show tendencies towards behaviour difficulties—they become, temporarily at least, 'problem cases.'

Phases 2+ to 5+, 7+ to 11+, 14+ to 18+ on the other hand are periods of relatively slower physical and more rapid mental development. They are periods of greater vigour, increased resistance to disease, and general stability.

Here we are concerned mainly with the 11+ phase. However we must also take some account of the previous 7+ to 11+ phase for two reasons:

Some retarded pupils in post-primary schools display the mental and emotional characteristics of the junior-school phase.

Since it is essential to maintain continuity of treatment from primary to post-primary schools, the teachers in the latter should take cognizance of the work characteristic of the junior schools from which they derive their pupils.

Junior-school Phase—Age 7+ to 11+ Years

Physical Characteristics

This is a period of consolidation with rapid increase in strength and endurance, giving the child a wider range of activity and greater personal independence.

Finer muscle-control improves, making increased deftness and speed of action possible.

Sensory Characteristics

During this period vision reaches full development and the kinæsthetic (muscular) sense improves rapidly up to the age of about nine years. Thus, towards the end of this period the pupils are able to make finer sensory discriminations, such as are involved in reading smaller print and handling more difficult tools.

Emotional Attitudes

With increase in strength and muscular co-ordination come greater self-assertiveness and personal independence. In boys this may take the form of pugnacity leading to individual or gang rivalry. In girls it tends to become a desire to 'dress up,' recite, or act before an audience.

The gregarious (or herd) tendencies become markedly stronger, particularly with respect to the same sex. Boys and girls segregate, the normal child showing little interest in the opposite sex.

Emotional control increases, partly owing to the increased self-confidence derived from a consciousness of greater strength and skill. The child recognizes his growing ability to deal successfully with his normal environment. Instead of weeping and running for help in an emergency to older persons, the boy and girl now face up to difficulties and the bolder spirits look for new difficulties to conquer. They despise fits of childishness, take a pride in bearing pain without flinching, and above all, they *strongly resent being treated as infants.*

Intellectual Characteristics

During the years from about 9 to 11 marked intellectual changes take place. Interest is directed towards the external environment. Boys particularly, wander abroad and explore a wider area of the countryside. Many children collect objects such as stamps, birds' eggs, and cigarette-pictures. In both sexes we can observe a

strong practical bent shown by an interest in making things, particularly such as are useful and will work. In boys this interest tends to specialize in mechanical contrivances.

During this phase the children become more assertive and independent intellectually. They are more critical, and less suggestible. Interest wanes in fairy stories in which impossible happenings are depicted. It is realized that animals and flowers do not speak and act like human beings in real life. There is now a strong demand for reality. Stories must be true, or at least be about real things. Hence during this period there is a rapid gain in useful factual information.

Concrete visual imagination is strong. At the same time the ability to comprehend logical relations increases, and with it goes an improvement in ability to reason. These changes can be measured by the children's increasing power of interpreting pictures and detecting logical absurdities.[1]

Educational Treatment

From this review of physical and mental characteristics we can infer certain educational procedures appropriate to this junior-school period of development.

The increase in endurance, strength, and finer muscle-control makes possible the mastery of writing, drawing, and management of small tools. The increase in skill is accompanied by a strong spontaneous interest in gaining skill. Many games during this period take the form of practice in skilled habits, for example, throwing-games, marbles, tip-cat, skipping, hop-scotch, cricket, and football. We may note also the normal boy's fondness for carving and whittling with a penknife, and in girls an interest in such domestic arts as weaving, knitting, dress-making, and cookery.

The interest in exploring and collecting makes an excellent foundation for work in nature-study, elementary science, surveying, and out-door geography.

In literature the interest in factual knowledge and real people may be satisfied by stories of explorers, soldiers, sailors, inventors, and women pioneers in various fields of human endeavour. There is a strong preference for epic and ballad poetry, and dramatization. The *descriptive* aspects of geography, history, science, and mechanical invention will lay the foundations for later more abstract and theoretical subject-matter.

[1] *Cf.* the Binet-Simon series of intelligence tests.

The abundant energy, vivid concrete visual imagination, interest in practical skill characteristic of this period make it obvious that *as far as possible instruction should be carried on mainly through practical activities.* This is particularly true of the teaching of mathematics, elementary science, and geography. Narrative and description should be presented in simple concrete form couched in words which are intimately connected with the pupils' local environment. The children at this period are not yet mature enough for abstract theoretical lessons and formal expositions. Since voluntary control of movement and attention is still only partially developed, teachers should aim at the provision of a *variety of occupation* even within the same time-table period. College-trained students, when beginning to teach, are much too prone to make their lessons into formal lectures in the approved academic style. Such a method of teaching may be suitable for senior pupils and adult students, but it is most emphatically out of place in the education of junior-school pupils. The Project Method, with its variety of occupation and possibilities of practical work all centred round a simple problem to be solved, or model to be made, can be employed particularly well in the junior school.

Finally, the gang interest and the strong rivalry of this period can be turned to good account in team-games and team-competitions in school-work.

This analysis of educational treatment appropriate for the junior school has a considerable importance even for teachers intending to specialize in post-primary work.

In the first place, the characteristics of the 7+ to 11+ period change not abruptly, but gradually, into the characteristics of the post-primary period. Therefore there is an interim period even in secondary-school practice during which the methods of the junior-school period may be used with advantage.

In the second place, since many pupils develop more slowly than is normal, we shall find some in all senior schools and most secondary schools who, although their chronological age may be more than eleven or twelve years, still show the mental characteristics of the junior-school period. These are the pupils who populate the 'C' forms and 'Removes' of the post-primary schools. For them the more formal abstract methods of secondary education are quite unsuitable. Their training and instruction should still retain some of the characteristics appropriate for the junior-school period.

TEACHING-METHODS BASED UPON PRACTICAL ACTIVITIES

We have seen that in the junior-school period, sense-organs and large muscle-co-ordinations mature. The child at this period is interested mainly in observing and describing people and things. He seeks to establish control over his body, and over the environment. He amasses a good deal of information, but of a *concrete kind related to things and people as such, and to his own practical interests.* In making the acquaintance of town and countryside he does not differentiate between knowledge as physics, geography, history, or biology. He is more interested in the things themselves and their uses than in comparing and analysing them.

The junior-school pupil can and does reason in a simple way. He begins to connect cause and effect in practical situations. He can detect simple absurdities and make practical inferences. These reasoning-processes are related, however, at this stage to concrete experiences. *Abstract* thought-processes are only just beginning to appear in the majority of children at the *end* of the junior-school period.

At this period progress in the grasp of such logical relations as those of quantity, quality, identity, likeness, and difference is bound up with bodily activity. *Movement is a medium for intellectual development.*[1]

Hence it is of the greatest importance that students-in-training should consider exactly what is involved in methods of teaching through practical activities. The aim of such activities is not to enable the pupils to skip about in aimless fashion, or play with wooden blocks and pairs of scissors. The aim of practical education at the junior-school period is *intellectual* development, because such development at this period is best fostered through the medium of practical activities. To make this concept clearer two examples of experiments in teaching and learning through practical activities will be described. These two experiments are interesting for the further reason that they were arranged in such a way that the practical method of teaching junior-school pupils could be compared in efficiency with other possible methods.

1. Dr P. B. Ballard wished to test the relative efficiency of an ingenious piece of demonstration apparatus for teaching fractions.[2]

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[1] See in this connexion the section on relation between language and intellectual development, p. 182.

[2] See *Handwork as an Educational Medium*, p. 103.

This apparatus was "as admirable a device as could be conceived for rendering the equivalence of fractions, and the simple operations, perfectly clear." Two classes consisting of boys and girls about eight years of age were chosen. These pupils had received no previous teaching about fractions. All the brighter children were placed in class A, the rest into class B. For six months both classes worked at precisely the same scheme of fractions for precisely the same time per week. The conditions of work were as similar as possible except that class A (the *brighter* scholars) was taught by means of demonstrations in which the apparatus was *manipulated and described by the teacher*, while class B (the *duller* pupils) was allowed to measure fractions, cut out pieces of paper, and compare them by super-imposition, etc. After six months' work the two classes were tested, and class B, *the duller children*, showed a distinct superiority. Learning by doing had outweighed the advantages of superior natural intelligence and ingenious demonstration apparatus!

2. An experiment which extended over a complete curriculum for a year was conducted in a girls' school in Exeter.[1] Two classes of eight-year-old girls were arranged so that they were equal in average age, intelligence, and school-attainment.[2] Their general health and physical condition were tested by the school medical officer.

The two groups worked through a similar syllabus for a school year.

The first group was taught collectively by traditional class-methods. The pupils sat at six-foot desks, had no room for free movement, and did a minimum of practical work.

The second group had ample floor-space for dramatic work and games. They were taught as far as possible by individual methods with the aid of apparatus manipulated by the pupils themselves. Formal instruction was reduced to a minimum in all subjects. These pupils had no direct instruction in spelling and grammar. "Recitation, music, and singing were taught by eurhythmics . . . *because the bodily movement associated with eurhythmics is especially valuable and truly instructive to children of an age when all expression is closely allied with, and best realized by physical sensation.*" Literature was taught entirely by the dramatic method. The children acted every story or poem presented to them, gesturing and moving about as they wished. History, geography, and nature-study lessons were also dramatized when feasible. A special period was set apart for modelling, free drawing, and paper-cutting in connexion with these subjects.

The first group had a competent experienced teacher trained in class-teaching procedure, and convinced of the value of that type of school-work. The teacher of the second group, although trained more particularly in class-teaching, was interested in the freer methods

[1] Eve Macaulay, *Forum of Education*, Vol. VI, No. 3, Nov. 1928, p. 217.

[2] As measured by standard intelligence and attainment tests.

already described, and wished to experiment with them. However, she had had only a little practical experience of these methods. Thus the advantage in teaching-efficiency was enjoyed by the first group.

Both groups of pupils were tested at the end of the experimental period. The tests indicated a general superiority of the second group over the first. These pupils showed a more thorough knowledge of arithmetical method, had better comprehension of material read, wider vocabulary, better style in composition, *richer content of mind*, and were more fluent in speech. In history, geography, nature-study, literature, and hygiene in which they had less time devoted to class-teaching and more to expression in either handwork or dramatization, the pupils in the second group were more fully informed than those in the first group. "In examination, the members of the [second] group spoke of people and events as if they *knew* or *had witnessed* them; their interest was real and personal; they could draw or model quite recognizable reproductions of the lives, homes, tools, weapons, clothes, and so forth, of the subjects of history and geography lessons. . . . Their general attitude to work was that of being eager to discuss what they were doing or had learnt, and one gained the impression that everything of which they spoke *was a reality* in which they were joyously absorbed.

"In the first group the children were well and soundly, but less extensively informed; their answers to questions tended to be in set phrases, and they appeared *unable to discuss their work beyond the reproduction of portions of lessons or of notes which they had written.* The examiner was unable to extract any expressions of personal opinion or of preference from individual members of this class."[1]

A word of warning is relevant here. The fundamental aim of this teaching founded upon practical activity is not practical skill but *intellectual* development, because intellectual learning at this phase is most easily acquired through the medium of practical activities. This is not equivalent to asserting that practical activity is essential for intellectual learning at every phase of development. When the normal pupil has reached the adolescent phase he can think in words and understand abstract ideas to a much greater extent. Therefore he does not need practical activity to the same extent as was the case at an earlier phase of development.[2]

Hence it is not necessary to carry on a preponderance of practical activity in learning throughout the whole of school-life, as has been done by some enthusiasts for reformed methods of teaching. When the pupil can do his mathematical reasoning in terms of abstract

[1] Report cited, pp 225–6. The italics are mine.

[2] Note again the influence of language-development.

symbols and verbal formulæ then it is desirable that he should do so, since the process is more scholarly and efficient. It is just as absurd to make clever adolescent pupils solve mathematical problems by counting beans and arranging match-sticks as it is to make young junior-school pupils use abstract symbols and formulæ. At all phases of development we should aim at suiting the methods of teaching and the type of work to the degree of maturity of the pupils' powers.

This warning brings us naturally to the consideration of the characteristics of the post-primary phase of development.

Post-Primary Phase—Age 11+ to 18+ Years

In this period we are concerned with two sub-phases of development, namely, the pubertal phase roughly from 11+ to 15 years, and the post-pubertal phase from 15 to 18 years.

PUBERTAL PHASE: 11 TO 15 YEARS

Physical Characteristics

The most striking features of this phase are the rapid increase in height and length of limbs, together with changes in sex-organs and secondary sex-characteristics. The children lose their childish appearance and turn into young men and women. In the case of boys, the voice 'breaks' and takes on a deeper register. Hair appears on the face. The girls' figures mature and menstruation begins.

These physical changes set up a need for extensive re-adjustment. This phase, particularly in boys, is often characterized by an awkward clumsiness, and this, in its turn, causes a feeling of shyness.

In both sexes, the rapid physical changes are accompanied by periods of lassitude with a disinclination for intense and prolonged effort and concentration, either physical or mental.

It is a period of physical instability during which after-effects of previous illnesses tend to appear in more malignant forms, and there is increased liability to disease.

Emotional Attitudes

This phase is accompanied by equally characteristic changes in emotional attitudes. These are caused partly by the physiological changes in sex-organs, partly by the growing individual's conscious-

ness of these changes in relation to the environment. Many children are awkward, shy, and solitary. They become pre-occupied with self and uncommunicative. They lose, for a time, the easy, confident, optimistic attitude of the junior boy and girl.

The boy tends to become a hobble-de-hoy—a figure of fun. He grows out of his clothes. His movements are clumsy. He makes mistakes easily. Thoughtless friends are apt to tease, and in desperation the tortured youth either retires into a voluntary solitary confinement where he cannot be seen, or he compensates for his feeling of inferiority by putting on a show of insubordination, and dogmatic or even rude self-assertiveness.

In both sexes, but particularly in girls, the onset of normal sexual functions, unless accompanied by wise instruction, may give rise to dismay and even fear. It is not surprising therefore that many children during the pubertal period present distinct problems in behaviour to both parents and teachers, and special care is necessary during this phase.

Intellectual Characteristics

This is a period of intellectual transition. Imagery becomes less vivid and concrete, with increased ability to think in words. The power of abstraction increases. This means that the boys and girls develop a greater ability to comprehend more and more subtle and complex logical relations. Their power of formal reasoning improves together with increased interest in logical principles and in the process of reasoning itself.

Increase in power of comprehension leads to a corresponding progress in systematizing knowledge into organized, specialized subject-matter. Moreover, the individual at this phase begins to take longer views and interest in future careers increases.

At the same time it is essential to remember that these intellectual changes do not take place abruptly. The junior pupil of 10+ does not wake up on his eleventh birthday a complete adult. The junior pupil loses his childish intellectual features slowly and acquires the full adult intellectual features correspondingly slowly. This pubertal phase from about eleven to about fifteen years is a transition period.

Educational Treatment

During this transition period the following rules for educational treatment are important :

(*a*) Great care is necessary to avoid both physical and mental over-strain. Good feeding, adequate rest and sleep are essential. Boys and girls, during this phase, should not be allowed to undertake excessive physical effort in gymnastics or games, and in no case should such effort be demanded by over-anxious or officious adults. Wise restraint is often necessary, since the pupils emerging from childhood are only too eager to demonstrate that they are already adults. In this expansive mood they will drive themselves to attempt feats of strength and endurance which only an adult athlete can perform safely.

(*b*) It is necessary to distinguish carefully between lassitude and laziness in these pupils. The rapidly growing youth may find it impossible to concentrate on mental work for any long period. Moderation in the demands for effort should be the keynote of educational management during puberty. This rule needs to be kept in mind when home-work is given in the secondary school.

(*c*) The period is important in the youth's moral and social development. Parents and teachers need to acknowledge with sympathy the new status of the boys and girls. An increase in independence and self-government is indicated. Wise sex-instruction is desirable.[1] The object of this should be to induce the attitude that the sex-changes of which the young people are conscious are natural and normal. Instead of being signs of abnormality or even disease, they are actually indications that the period of full adult development is approaching. Every opportunity must be used at this rather difficult period to strengthen the feeling of normality and the sentiment of self-respect.

(*d*) Intellectually, a sufficiently gradual transition is indicated from the more descriptive, practical, concrete instruction of the junior phase to the more formal abstract generalized treatment of subject-matter suitable for the mentally able adult. The change has been made, on the whole, too suddenly, particularly in secondary schools where examination preparation determines so much of the intellectual activity of both pupils and teachers.

Over-specialization also should be avoided in the arrangement and presentation of subject-matter. The connexions between English and Latin grammar; between history, economics, and geography; between arithmetic, algebra, geometry, and physical science need to be stressed. For this reason it is very desirable that the same teacher should have charge of groups of cognate

[1] See note at the end of this chapter.

subjects in the senior schools, and in the lower forms of secondary schools. Formal theoretical specialization of subject-matter is best left to the post-pubertal period.

POST-PUBERTAL PHASE: 15 TO 18+ YEARS

This is a second period of consolidation. Normal adolescents now approach the adult phase of development and begin to assume full responsibility and independence.

There is an increase in physical and mental vigour and endurance, with greater voluntary control of attention and movement. Hence greater demands for sustained effort may now be made. This period is characterized by rapid increases in knowledge and skill.

Self-confidence and sociability increase and the normal attraction between the two sexes develops. Closely allied with the development of sex-sentiments are the interests in poetry, music, literature, and the fine arts.

On the intellectual side, the adolescent completes the full development of intelligence during this period. This indicates that more stress may be placed, in teaching, upon the formal, abstract, generalized aspects of knowledge and skill. The pupil now welcomes systematization and deductive presentation.

There is a corresponding development of the powers of criticism. Intellectual, ethical, and æsthetic principles and standards of value can be recognized explicitly and applied by the abler pupils to scholastic and social problems.

INDIVIDUAL DIFFERENCES IN DEVELOPMENT AND THEIR SIGNS

Since ancestry varies so widely we must expect wide differences between individual pupils in school, in both hereditary aptitudes and rates of development.

Good teaching and school-organization must take account of these differences, since effective learning is so intimately bound up with mental and physical development. In previous sections we have attempted to sketch a general picture of the main phases of human development. This, however, cannot be more than a general guide in teaching. While we may anticipate the probable characteristics likely to be shown at a given period of development by reference to this general picture, the precise endowment and phase of development of any particular pupil can be estimated only by careful observation of that pupil's abilities and interests.

The estimation of individual pupils' endowments and attain-

ments has been made more accurate and easy by the development and use of psychological and educational tests. These tests are now administered in many schools as part of the normal school routine. However, not every teacher has access to the results of psychological tests. How then can rates of development and the ripening of new aptitudes be discovered? What signs should be looked for in the pupils? Three signs are significant:

UPRISING OF NEW SPONTANEOUS INTERESTS

The approaching maturity of some given aptitude is invariably marked by a strong spontaneous interest in the corresponding activities. This has already been illustrated in the cases of walking and talking. It is as though the uprising aptitude craves its appropriate exercise. Hence the child's spontaneous interests are a good indication of maturing functions.

Several signs will indicate spontaneous interests. The more important of these for the teacher's information are:

Spontaneous questions—the child seeks information about his interests.

Pupils' own reports of what they do in their out-of-school time, *e.g.*, hobbies, nature-study occupations.

Type of books selected for private reading.

Type of activity selected by pupils during free periods in school, *e.g.*, modelling, drawing, constructive handwork; literature (prose or poetry); mathematical puzzles or games with a mathematical interest such as chess, cribbage, games of chance; scientific discovery, invention, and practical experiment; gardening.

If teachers will look for and note such signs in the pupils, they can often estimate not only the ripening of some new special aptitude, but also the kind of special aptitude concerned. Such knowledge provides a guide when it is necessary to prescribe reading and exercises appropriate for a given pupil, or advise about the choice of suitable subjects for study, and suitable occupations for a career.

It is essential, of course, that if the observation of such signs is to be made, the school-organization and classroom-conditions must allow to each pupil some degree of freedom of choice. In a dead-silent classroom, where every exercise is performed simultaneously by the pupils, by numbers, at the word of command, a teacher may look in vain for any signs of spontaneous interest.

ONSET OF RAPID IMPROVEMENT

This sign of approaching maturity of function is well illustrated by the course of progress in walking and talking already mentioned. A ' fallow ' period is followed by a spurt of improvement. Such spurts are familiar to all child-observers, and they indicate that a period particularly favourable for a corresponding type of activity or subject-matter has arrived.

ABSENCE OF STRAIN AND FATIGUE

Any new exercise tends to be difficult at first, calling for intensive concentration of attention. If the pupil is not yet ready for the exercise the strain continues in spite of practice. The task is mastered only slowly. The pupil shows a reluctance to engage in the work, and even short practices produce signs of fatigue and aversion.

These signs are apparent when a child is introduced too early to some form of skill, *e.g.*, writing with a pen. The child's movements are jerky. The body is held in a tense unnatural position. The movements instead of being confined to a local system of muscles in hand and arm spread or ' irradiate ' to the whole body. Although the child may be attempting to write, yet his trunk and legs move, he puts out his tongue, and makes grimaces. If he is forced to continue the practices at this stage, the strain may set up muscular twitch and tremors. If these symptoms persist the work should be stopped and the exercise postponed to a later period.

On the other hand, if the child is ripe for the work the movements are easy and rhythmic, improvement is rapid, and there is absence of ' irradiation ' and premature fatigue.

Direction of Development

When we are concerned with the organization of a syllabus of work covering a period of years, it is essential to take account of the *direction* of development.

It is found that, in both physical and mental development, progress goes *from more general to more detailed and specialized functions*.

In physical training, for example, the earliest exercises should involve large muscle co-ordinations in trunk and limbs. As training proceeds the exercises may be made more specialized, using more

limited sets of muscles and requiring greater concentration of attention, care being taken to avoid introducing finer muscle-co-ordinations before the pupils' physical development is ready for them. The principle may be studied in more detail by comparing the exercises prescribed for infant, junior, and senior pupils in a modern physical-training syllabus.

Similarly free-arm drawing should precede free-hand drawing; writing with a large pencil precede writing with a pen; reading large print precede reading small print.

A NOTE ON SEX-INSTRUCTION

This aspect of education is, perhaps, only incidental in a teacher's work. Nevertheless it is an important aspect which cannot be completely ignored by teachers of adolescents. Public instruction about matters of sex may not be desirable. At the same time teachers frequently find themselves faced with difficulties in individual pupils, and they are occasionally approached by parents who are not sure how to treat their own children. It seems desirable therefore to include a short discussion of this problem, and incidentally it affords an illustration of the need for continuity and gradualness in methods of treatment.

It has been supposed that sex-changes take place quite suddenly—even catastrophically—at puberty, and that children, before this period, should be in no way interested in, or concerned with sex-knowledge. By some people, any interest in this direction before puberty was considered to be a sign of abnormality and feared accordingly.

There is no foundation in fact for such beliefs. The two sexes are different from the time of the first cell-division. Rates and rhythms of development show characteristic differences between the sexes throughout development. Further, there appear to be differences in interests and preferences greater than can be explained away by reference to environmental influence only. These differences are not great enough to make it either impossible or undesirable to teach boys and girls together, particularly before puberty.[1] Nevertheless the fact of difference should be recognized.

Sex-differences are not phenomena which make a sudden and mysterious appearance at puberty. Most authorities on the physiology and psychology of adolescence are now agreed that the supposed cataclysmic nature of sex-changes at puberty is largely illusory. Actually, much of the difficulty associated with this period is due, not

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[1] Except that the greater physical strength of the average boy makes separate treatment for physical training and games desirable after about nine to ten years of age.

so much to the sex-functions themselves, as to the customary 'hush-hush' attitudes towards sex-matters and to the very sudden environmental changes which occur when boys and girls of fourteen or sixteen years leave school and begin to work for a living.

In the first place, any sign of interest in problems of sexual reproduction may have been condemned out of hand by parents (and teachers) as wicked and unnatural, and the child made to repress them forthwith.

In the second place, the change from school to livelihood coincides with puberty in the majority of children. At fourteen, some children are at school up to the end of one week, and at work in a factory, warehouse, or mine at the beginning of the next week. This is indeed a sudden change.

The activities as well as the intellectual and moral standards of the factory are very different from those of the school. A drastic process of re-adjustment is demanded of the youth. Further, the fact of working and earning money has a strong influence on the self-feeling of boys and girls. From being school-pupils dependent on parents and subject to the authority of teachers, they feel that they are very nearly, if not quite, men and women. This enhanced self-feeling expresses itself in claims for independence. Parents or elder brothers and sisters, however, still regard the adolescents as boys and girls, and are by no means disposed to yield to such claims. This is a frequent cause for conflict and emotional disturbance.

Too many children receive no reasonable sex-instruction whatever. They gain what knowledge they can, surreptitiously. When parents do instruct their children, the instruction is apt to be given too suddenly. A solemn occasion is arranged, and the child made to suppose that a rather guilty secret has been divulged, and which must on no account be talked about as it is not quite 'respectable.'

Or, parents who pride themselves on their modernity and freedom from Victorian taboos go to the opposite extreme and unload all the details about reproduction on their unfortunate offspring just as soon as the latter ask their first childish questions. This procedure may be as dangerous, particularly for girls, as a refusal to discuss the questions at all. In fact, it is not too much to say that some sensitive young girls may be so profoundly disturbed by this treatment that their emotional attitudes towards the physical aspects of sex are conditioned unfavourably for the rest of their lives, and if they marry they may find it impossible to make the adjustments which happy marriage requires.

Just as the physiological and emotional changes in sex-development are gradual and cumulative, so sex-instruction should be gradual and cumulative. Children's questions should be answered in a simple, straightforward, *matter-of-fact* way just as any other request for information would be answered. The answer should be just sufficient

to meet the question and so satisfy the interest at that time. No more is required.

Probably the best approach is to be found in the study of plant and animal breeding, and in keeping pets. The problems then arise normally and are capable of objective treatment along with the other facts of natural history.

Some parents fear that it is unwise to allow any mention of sex-problems, much less discuss them openly, on the ground that a persistent and morbid interest will be aroused in the child's mind. Actually, interest in matters of sex appears to follow the same courses as any other kind of interest during childhood. If questions are answered in the same way as any other request for information, the interest is satisfied and the child passes on to consider other matters. A persistent and morbid interest is much more likely to be fostered by a refusal to answer questions, particularly if the presence of a mysterious secret is suggested to the child. Unsatisfied and thwarted interests are the ones which persist and worry the inquiring individual.

Class-instruction in sex-matters for children of school-age is not always desirable. In many cases advice is best given to individuals as occasion arises. These suggestions have been offered as a guide to teachers and parents, since they will almost certainly be faced with the problem at some time.

Exercises and Topics for Further Study

NOTE TO READERS

Limitations of space forbid an extensive discussion of several topics of considerable interest to more advanced students of educational theory and practice. It is suggested that students wishing to proceed further into the study of special topics should, either in groups or individually, read and summarize the sources which will be indicated at the ends of chapters in this book. To facilitate this further work, topics for more intensive study will be suggested.

In addition to theoretical study, each reader should endeavour to carry out some practical exercises. A special note-book should be kept into which records and observations can be entered systematically.

TOPICS FOR FURTHER STUDY

1. Consult the references given in the text and summarize the evidence for the influences of hereditary and environmental factors in human development.

2. Examine critically the evidence for and against (*a*) the recapitulation theory, (*b*) the culture-epoch theory.

What relation had the culture-epoch theory to the general psychology and pedagogy of the Herbartian school of thinkers ?

3. Summarize the evidence put forward by Piaget in *The Language and Thought of the Child.* How far do you consider this evidence to be conclusive ? Does the evidence support Piaget's hypothesis of changing instincts ? What alternative hypotheses are possible ?

EXERCISES

1. Make a list of environmental influences which seem likely to (*a*) encourage, (*b*) discourage, the best development of a human child. How is your answer connected with the following : school-meals ; school-buildings ; organized physical training ; over-crowding at home ; unemployment of parents ; female labour in factories ; child-labour in homes and factories ?

2. Consult medical histories of (*a*) a group of very bright pupils, and (*b*) a group of educationally retarded pupils. Compare the records. Can you find any common differences ?

3. Make careful records of the speech-forms of some selected pupils. Compare your results with those given by Piaget. Can you find evidence in your observations for his distinction between *ego-centric* and *socialized* speech. At what age do you first find evidences of socialized speech in the pupils observed ?

4. Select certain pupils and make regular measurements of their height, weight, general health, and educational progress over a period of years. Is their development uniform or variable ? Can you find any connexion between variations in height, weight, and general health on the one hand, and in educational progress on the other hand ? (See Kerr, *Fundamentals of School Health.*)

5. Select groups of (*a*) infant-school pupils, (*b*) junior-school pupils, (*c*) senior- or secondary-school pupils. Note their ages, their sex, and educational attainments (*e.g.*, backward, normal, superior). By observing their play and other activities, and by judicious questioning, try to obtain a list of their predominant interests.

Compare the results of the three age-groups. What similarities, differences, can you observe ? Do you find any marked sex-differences ? If so, do they occur at all ages, or at what particular age ?

BOOKS FOR FURTHER REFERENCE

BOARD OF EDUCATION: *Handbook of Suggestions for the Consideration of Teachers.*
,, ,, *Report of Consultative Committee on Infant and Nursery Schools.*
,, ,, *Report of Consultative Committee on the Primary School.*
,, ,, *Report of Consultative Committee on the Education of the Adolescent.*
,, ,, *Report on Psychological Tests of Educable Capacity.*
,, ,, *Report on Secondary Education.*
BODE: *Conflicting Theories of Education.*
BÜHLER: *From Birth to Maturity.*
BOLTON: *Principles of Education.*
COGHILL: *Anatomy and the Problem of Behaviour.*
CHADWICK: *Adolescent Girlhood.*
HAZLITT: *The Psychology of Infancy.*
MURCHISON (Editor): *Handbook of Child Psychology.*
HUMPHREY: *The Nature of Learning.*
JENNINGS: *The Biological Basis of Human Nature.*
ISAACS: *The Children We Teach.*
,, *Psychological Aspects of Child Development.*
,, *Intellectual Growth in Young Children.*
KOFFKA: *Growth of the Mind.*
KERR: *Fundamentals of School Health.*
HOLLINGWORTH: *Psychology of the Adolescent.*
PIAGET: *The Language and Thought of the Child.*
,, *Judgment and Reasoning in the Child.*
SPENCER: *Essays on Education.* (Everyman's Library.)
WATSON (and others): *Suggestions of Modern Science concerning Education.*
WHEELER: *The Science of Psychology.*
MURCHISON (Editor): *Handbook of Child Psychology* (2nd Edition, 1933).
MONTESSORI: *The Secret of Childhood.*
FLEMING: *A Study of Growth and Development.* (Medical Research Council, Special Report Series, No. 190.)
COADE (Editor): *Manhood in the Making.*
ROSS: *Groundwork of Educational Psychology.*

SECTION II

MOTIVATION AND INTEREST

CHAPTER III

MOTIVATION

Some understanding of human motives is indispensable for successful teaching. The teacher's best work will not be done unless pupils are actively interested and pursue the work with zest. This applies particularly to monotonous repetitive work which is inseparable from the acquisition of a high degree of skill in games and occupations like writing shorthand or using a typewriter at high speeds. The study of motivation is therefore very important for teachers of technical subjects. In addition, good school-government and class order are best established upon a basis of interest and goodwill in pupils.

Some of the teacher's difficulties are due to apathy arising out of a general low level of vitality and interest. Many more, however, arise from a conflict of interests, the pupils being much keener on outside activities than on school-work.

There are, of course, two rough-and-ready methods of inducing interest in school-work. One is to make the pupils so averse to painful punishment that they turn to their work as the lesser evil. This produces at best only a grudging effort, usually accompanied by evasion and a growing dislike for any form of education. The other is to allow all pupils to do what they please when they please. This also is open to serious objections. It is not practicable in a normally conducted school. It is not conducive to a sane discipline, either moral or mental. Further, it is educationally unsound. Children are not always good judges of educational value. They tend to choose the easiest tasks which seem most profitable at the moment. In education a long view is often essential. What is easiest at the moment, like counting on the fingers or using a typewriter with a finger and thumb, may be positively harmful in later years when a high degree of skill is needed. Moreover, it is very doubtful whether we ought to remove all difficulties

from a child's occupations. Effort is essential for full development. Difficulties conquered bring pleasure and confidence, and help to build up self-respect.

In this section we shall consider the sources of human effort and try to discover how children can be induced to attack all their work with zest.

The doctrines of human motive have had a long and chequered history. It has been suggested that the one universal motive is the desire to gain pleasure and avoid pain. Common observation will show that this principle is by no means universally true. If it were, it is difficult to understand how some very brave but at the same time very dangerous enterprises are ever begun. It has been suggested that we all seek to realize imagined future pleasures, and to avoid imagined future pains. This is true of a good deal of the behaviour of sophisticated adults, but it is certainly not true of young children. It has been suggested that ideas act as forces and so determine our motives and interests. This was the Herbartian theory of motive and provided the basis for the Herbartian system of teaching-methods. If it were true it would be ideal for teachers, since it would follow immediately that a teacher could determine the interests of all his pupils by the simple expedient of organizing their ideas. Unfortunately for this 'teacher's psychology' the study of hypnotism and the practice of psycho-analysis have shown, without doubt, that ideas are effects rather than causes. It is necessary to explain ideas in terms of motive rather than motive in terms of ideas. This must be so, since young babies seem to have motives before they have had time to develop ideas.

The most recent fashionable explanation of human motive is that in terms of instinct. On examination, however, this explanation seems even less profitable than the others. In the first place, no two authorities seem able to agree about what an instinct is. The whole topic is chaotic with confusion. In the second place, in normal human life we seldom see any really instinctive behaviour, and if we do, we regard it as childish or brutish, look upon it with repugnance, and endeavour to modify it or suppress it as soon as possible. The instinct doctrines of motive have little value for educational theory. They are misleading even in the study of animal behaviour.

All these historical suggestions suffer from the same defect. They all endeavour to give one simple, all-inclusive answer to a

problem which does not admit of a simple solution. They are all partly correct, and all partly wrong. Each has selected one significant factor in motivation and made that into a complete explanation of all behaviour. Present-day students have the advantage of a great deal of patient and accurate physiological and psychological investigation. Here we shall endeavour to give a more comprehensive theory of motive without committing ourselves to any one traditional school of thought. We can best begin by trying to describe the *facts* of behaviour.

Striving and Conation

We can study behaviour from two different but related points of view:

(*a*) That of an *external observer* noting changes in the behaviour of other people.

(*b*) That of an *internal reporter* noting changes in our own *experience* and correlating these with movements we make ourselves, and with movements we observe in other people.

On the basis of our personal experiences as we feel them, and our corresponding behaviour, we can then examine other people's behaviour and *infer* their probable experiences. In this way we can interpret their behaviour and their probable motives in terms of our own. In addition we can use observations of animal behaviour.

External observation indicates three main types of activity:

(i) Quick, more or less stereotyped non-rhythmic muscular movements, *e.g.*, turning the head following a sudden sound; sneezing if the nostrils are tickled.

(ii) Continuous rhythmic movements of various internal organs, *e.g.*, expansion and contraction of lungs, heart, stomach, and intestines.

(iii) Persistent activity of the whole creature towards some end-point. This persistent activity is maintained with variations in the form of the activity until either a result favourable to the creature is achieved, or it is overcome by fatigue.

Internal report reveals the following types of experience:

Awareness of objects and situations in the external environment, or of disturbances within our bodies, when the sense-organs are stimulated.

A feeling of interest, that is, a feeling that *what is experienced concerns us, or has some kind of value for us.*

Feelings of pleasure or its opposite, unpleasure ; elation or depression ; surprise ; satisfaction ; complacence ; nausea ; anger ; fear (among others).

A feeling of urge or 'drive,' a feeling that something must be done with regard to the experience noted. This varies from a generalized uneasy restlessness to a well-defined determination to achieve some clearly anticipated result.

We shall now try to co-ordinate these external observations and internal experiences into coherent patterns. Observation of ourselves and of other people and animals indicates that these movements and experiences are connected and ordered with respect to certain fundamental needs of the living organism. The living organism is a *self-regulating system*, the direction of the regulation being determined by the needs. It is this concept of regulation in accordance with needs which supplies the key to the understanding of motives and behaviour. This concept may be understood by reference to just one or two of the needs.

One of these needs is for food. We must eat to keep alive. However, the amount and kind of food eaten is important. Food is required for two main reasons :

To provide the material for building up and then maintaining the tissues of the body.

To provide energy. Part of this energy is used in maintaining the body at a suitable temperature. Part of it is expended as physical movement and mental activity.

Now there is a definite quantitative relation between the amount and kind of food we eat, and the rate of growth of tissue and the energy expended in action. Hence the amount and kind of food required by the body will vary from time to time. We shall require more food during periods of rapid growth. We shall require more food during periods of intense work. We shall require more food during spells of cold weather when heat escapes more quickly from the body to the air around it. Conversely we shall require less food in proportion as growth ceases, activity slows down, and the external temperature increases. All these facts can be corroborated by common observation. For example, the best way of starving in comfort, so to speak, is to retire to bed, cover oneself with blankets, and lie still.[1]

[1] This principle has been discovered empirically by many permanently unemployed workmen, who confirm its truth without knowing the reasons for it.

It follows from the above that for successful existence an *equilibrium must be maintained* between the amount and kind of food eaten and the changing conditions of the organism. If we do not eat enough the vitality of the organism decreases. If we eat too much the body mechanisms are clogged with surplus material and again vitality is depressed. *How then is this essential equilibrium maintained?*

When the food reserves in the body begin to be depleted we feel a hunger. Food-hunger begins as an obscure barely localized uneasiness and intensifies into a gnawing unpleasant pain.[1] *This food-hunger is accompanied by interest in food, or in any signs of food.* We cannot rest. If food is not immediately available we seek it. We *strive* to find it and the striving increases in intensity with the increase in hunger. The sense-organs—particularly smell—become more susceptible to signs of food. We are alert and disposed to pay attention to such signs. If the first efforts to obtain food fail, the striving continues. We keep on seeking, but vary our efforts according to what we can remember of past situations of a similar kind.

If we are still unsuccessful we experience anxiety, then fear. These feelings deepen into despondency and finally despair.

If we find food we eat, using both learned habits, such as handling a knife and fork, and primitive reflexes, such as biting, chewing, and swallowing. Having found food we are elated. Tasting it gives us at first intense pleasure; the greater the hunger, the more intense the pleasure. As we eat and approach repletion, pleasure in the eating subsides, the drive to eat diminishes, satisfaction supervenes, and finally we become *complacent* towards food. We have no further interest in it.

Now suppose we eat too much, or that food is forced upon us. We pass beyond the complacent condition. We begin to feel unpleasantly uneasy, and depressed. If the forced feeding continues, the unpleasure and depression increase accompanied by pain, nausea, and disgust. We now *strive to get away from* even the sight and smell of food. *In extremis* we ease the tension by sickness. When the tension is eased, we feel pleasure and some degree of elation, finally reverting to the mid-point of satisfied complacence with respect to food.

We can trace a similar cycle of events in connexion with several

[1] It has been shown that the pain is caused by increased activity of the rhythmic expansion and contraction of the stomach muscles.

other vital needs such as the needs for water, or for a correct body-temperature. Further, each sense-organ seems to have an optimum degree of stimulation which produces satisfaction. If the light stimulation in the eyes is too intense we seek to reduce it, if it is too feeble we seek to raise it. Each time the object of the striving is to re-establish the conditions in which we feel comfortable and satisfied.

It is noteworthy that this striving towards the conditions of satisfaction goes on both at a sub-conscious and a conscious level. The striving for a satisfactory intensity of light-stimulus is a good example. If the intensity of the lighting decreases slightly, the eye-mechanisms adjust themselves involuntarily. The pupils of the eyes are enlarged. The eyes are opened more widely, and the person concerned peers ahead more intently. If the lighting increases the pupils decrease, eyelids are partially closed, the eyeballs retracted slightly, and the person withdraws from the source of light until adequate compensation has been achieved. These slight compensatory adjustments operate without the explicit knowledge of the person concerned. They are achieved by involuntary reflex processes. If, however, the involuntary compensatory adjustments fail to restore the conditions of satisfactory illumination we begin to *feel* discomfort and our *interest and attention are directed* towards the unsatisfactory situation. We then try various ways of alleviating the difficulty. At a still higher level of analytic thinking we seek the causes of the difficulty by the use of scientific knowledge and thus attempt to remove it.

THE BEHAVIOUR-CYCLE

We can express this striving behaviour in a general formula—a behaviour-cycle—which gives us a clue to an explanation of motive and interest. The cycle can be described as follows:

The normal condition of the living organism is one of complacent satisfaction. In this condition we are not interested in ourselves or our immediate environment. We do not pay attention and are not disposed to exert any effort. Physical and mental activity are at a minimum. The organism is in equilibrium with its environment.

Then the equilibrium is disturbed by changes either within or outside the body. The disturbance may take place in two directions, *e.g.*, towards depletion or surplus. The disturbance is followed first by an unconscious striving which tends to restore the equilibrium.

If this fails we become conscious, feel interest, pay attention to the situation, and strive with more or less deliberate intent to restore the condition of equilibrium.

When this condition has been successfully re-established, interest, attention, effort diminish again to a minimum and we resume the normal state of complacent satisfaction.

We can represent this behaviour-cycle diagrammatically (see Fig. 1).

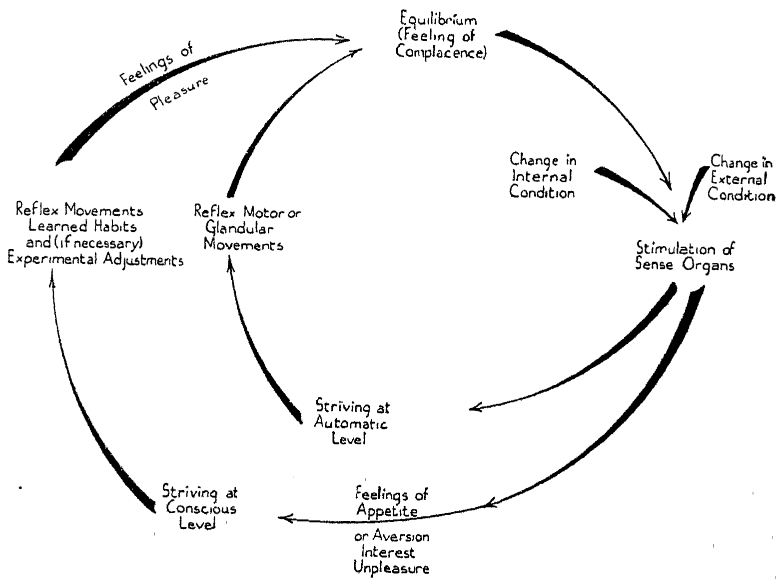

FIG. 1

In the next chapter mention will be made of other equilibria necessary for successful existence. At the moment we are concerned to clarify this view of the living organism as a self-regulatory system, striving continuously to maintain certain constant internal conditions against changes in the environment. This view enables us to give a clearer and more satisfactory description of motivation. It is the striving of a living organism to maintain the conditions necessary for its continued existence. The striving may be either unconscious, or conscious and deliberate. When striving is conscious it is called *conation.*

Motives are experienced in two forms either as *hungers* or *aversions.*

The Relation between Striving and Learning

These behaviour-patterns involving hungers and aversions are, for the educator, the most important features of human life because *learning proceeds most quickly and efficiently under the influence of the drives of hunger or aversion.* In fact, we can say that in the absence of hungers or aversions learning does not occur.

'Instinctive' Elements in Human Behaviour

It is obvious that this behaviour-cycle we have just described contains both native elements as well as elements which have been learned by experience, such as ideas and habits. Among these native elements we can detect:

The feeling of drive or urge.

The mère tendency to pay attention to objects of a certain kind related to the need of the moment.

The feelings of interest, pleasure-unpleasure, elation-depression, nausea, anger, fear.

Primitive reflexes such as biting, chewing, swallowing, spitting out, wiping the lips after tasting something nasty, secretion of saliva, movements of eyes and limbs, and so on.

These native elements of feeling and reflex response remain relatively constant throughout healthy life, no matter how elaborate a system of knowledge and skill may be built up by experience. Also, whenever the educated human being is in conditions of desperate need, or danger, acquired knowledge and skill are temporarily swept aside and behaviour reverts to primitive patterns. In disease and insanity this reversion may be permanent.

To some extent therefore it is legitimate to speak of instinctive elements in human behaviour if we mean by this term certain native propensities for feeling and acting which do not depend upon learning.

SOME SUBSIDIARY PRINCIPLES OF BEHAVIOUR

Having established the fundamental principle of motive and interest we must now glance at certain subsidiary principles of human behaviour which are relevant to the practice of teaching and school government.

PRINCIPLE OF LEAST ACTION

The human organism is an energy-system which has at its disposal only a limited supply of energy. As such it tends to obey a principle of least action. That is, it tends to behave in such a way that no more energy is expended in any given situation than is required to cope with the immediate difficulty.

This principle is exemplified in unconscious and conscious striving. Any disturbance of an equilibrium condition is countered first by primitive localized unconscious compensatory responses. Not until these fail do the more intense and varied conscious efforts to restore the equilibrium begin to operate.

This principle of energy-economy is met with frequently in school-work. Pupils are disinclined to use any higher mental processes so long as habitual conduct will satisfy their needs. Moreover, *any artificial demand for attentiveness and effort beyond the apparent need is resented and resisted by the pupils.*

We may note this peculiarity frequently in connexion with attentive observation. This function varies in intensity according to the needs of the organism at the moment. A full-fed animal does not notice food. Normal human beings select for observation just those details in the environment which are necessary for their particular task at the moment and they neglect the rest, *e.g.*, people neglect to count the buttons on their coats, or the steps in a familiar flight of stairs.

Claparède, a Swiss psychologist, has reported that he once asked a group of university students a question concerning some details of a large window on the main stairway in the college building. The majority of the students denied that the window was there at all, and only a few were able to answer the question. The students' need was to find their way to and from the lecture-room. The stairway itself was the means of satisfying the need. The window, although intrinsically as striking an object as the stair, was *irrelevant* to the need and therefore escaped attentive observation.

This point is important in school-practice because the question of improving the powers of observation by special artificial training is raised by education authorities from time to time. Some enterprising business man discovers with horror that pupils from the neighbouring elementary and secondary schools have not noted some detail or other to which he himself attaches great importance because it happens to concern him. Then the schools are accused

of gross inefficiency because they are said to have failed to train the pupils' powers of observation. Some school inspectors (who should have known better) adopted a habit some years ago, of asking small children questions about how many lamps or trees there were in the school street, or their home street. When the children could not answer, it was concluded either that the pupils were feeble-minded, or that the teachers could not teach. Hence there was a search for artificial ways of training powers of observation.

What is true of observation is equally true of remembering, imagining, and reasoning. These more complex mental processes require greater effort and more energy than habitual responses which will go on almost automatically. Hence there is a disinclination to use them deliberately *unless they are required by the organism in response to a need.* Therefore if we wish pupils to remember, imagine, or reason with concentrated effort, we must arrange the educational environment in such a way that the effort is *worth while and satisfying to the pupils.*

CHANGES IN THE LEVEL OF COMPLACENCE

The level at which complacence is established is a most important factor in connexion with interest and effort. According to the principle of least action, striving, and with it interest attention and effort, are at a minimum in the complacent condition. While that condition remains, learning will not take place, since there is no sufficient reason whatever why it should take place.

It is important therefore to consider how the level of complacence with respect to any particular need changes. It is altered both by training and by maturation.

An interesting example of the first occurs in the training of athletes. One of the most important results of athletic training is the raising of the level at which oxygen-hunger begins. The normal level depends upon body-build, and different untrained individuals have different levels.

When athletes begin to train, comparatively little exertion disturbs the oxygen-equilibrium and they quickly feel air-hunger, distinct unpleasure, and a strong desire for increased breathing. There is also an aversion to further exertion. As training proceeds, the level of the oxygen-equilibrium is raised. Exertions which previously would have produced laboured breathing, nausea, and aversion to further effort, now scarcely alter the breathing-rate. The exertions can be maintained over a much longer period and continue to be pleasurable.

Conversely, lack of exercise, sedentary occupation, illness may lower the level of the oxygen-equilibrium.

The influence of maturation on the level of complacence is shown by changes in appetite for food which accompany normal growth. As a child grows both the quantity and the quality of food necessary for complete satisfaction must be changed progressively.

The fact that spontaneous changes [1] in the complacence-level are induced by increasing maturity is important in education. The result is that the growing organism not only receives from the environment what is necessary for its present needs, but *it is constrained to seek what will satisfy it at the next approaching phase of development.*[2] It is as if the organism were continually preparing, a little in advance, for what it will become. It has already been pointed out that by noting spontaneous changes in interest the teacher can to some extent anticipate future needs and arrange an environment which shall be favourable to the development of the organism at the next succeeding phase of development.

When any physical or mental function approaches maturity, its exercise produces pleasure and elation. These feelings stimulate more energetic and repeated activity which in turn reacts favourably on the maturing function, assisting further growth until full maturity is established.

In addition to maturation and deliberate training, the general social environment may modify the level of complacence both upward and downward.

Consider the example of a skill-hunger. Suppose a healthy, well-grown boy or girl of eleven years old leaves his small village school and goes to a secondary school in another district. He will have been adjusted to the skill-level of his first environment. Arriving at the secondary school, he finds himself in an environment with a higher level of skill in games and athletics. Another type of hunger (which will be specified in more detail later) now comes into play to reinforce the movement-hunger of the boy. He compares his own achievements (with which he was previously quite satisfied) with the standards existing in the new school and he becomes dissatisfied. He seeks a higher degree of skill and endurance. This spurs him to increased effort and extended practice until his achievements produce satisfaction at the new complacence-level.

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[1] *I.e.*, changes arising from within the system of the organism, as opposed to external stimulation.

[2] *Cf.* Chapter II, p. 50.

Conversely, by attending a school with lower standards than his own, the skill-hunger tends to operate about a lower level of complacence.

We may anticipate at this point a later stage of our discussion and indicate another important implication of this condition of complacence. Since the human being has several needs he can experience several varieties of hunger and aversion. Thus a person may experience food-hunger, thirst, hunger for fresh air. He may also experience hunger for knowledge and skill. Now the teacher must depend for success in learning and teaching upon the pupils' hungers for knowledge and skill. But if the pupil is at the same time hungry for food, or warmth, or free movement, these hungers will conflict with those for the knowledge and skill which the teacher desires to impart. Hence, the teacher must contrive as far as possible *to satisfy the hungers for food, warmth, and free-movement, and establish a feeling of complacence with respect to them* while at the same time he disturbs deliberately the pupils' complacence with respect to further knowledge and skill. Some devices for doing this will be discussed later.

THE FUNCTION OF PLEASURE-UNPLEASURE FEELING-TONE IN MOTIVATION

Pleasure and unpleasure feeling-tones are not primary motives in that they do not *initiate* striving. Obviously, since striving commences below a conscious level, and in some cases does not reach the conscious level, it cannot be initiated by feelings of pleasure or unpleasure. At the same time these feelings do play an important part as *regulators of the duration of the striving.* We tend to prolong, or repeat, any process or condition which produces pleasure. We tend to cut short, and avoid repeating, any process or condition which produces unpleasure. The more intense the feeling-tones, the greater is their regulative influence.

The pleasure-unpleasure pair of feeling-tones appears to have no specific local reference. It accompanies a great variety of conditions and experiences and can be recognized over and above the specific qualities of each experience. One may be aware of an aromatic or savoury smell of a particular kind, *e.g.*, smell of benzene or of roast beef. At the same time as one experiences the smell one may also find it pleasant or unpleasant. Similarly, a harmony is pleasant, a discord unpleasant.

Pleasure-unpleasure depend upon the course of a process.

Generally speaking, *any situation which is developing towards satisfaction is found to be pleasant. Any situation which is developing away from satisfaction is unpleasant.*

Thus it follows that we may be suffering some unpleasant experience, but at the same time find the total situation pleasant. In music, we may be listening to a series of discords, each of which taken by itself would be judged unpleasant. However, from the form of the successive discords we anticipate that the end point will be a harmony. In so far as the individually unpleasant discords tend as a series towards an end-point of harmony, we find the situation as a whole *increasingly* pleasant.

Again, a person may be in a condition of considerable physical pain, yet at the same time suffused with a feeling of intense pleasure, *e.g.*, a badly injured soldier who has just been awarded the V.C. and cheered to the echo by his comrades. Here again the effects of the physical injuries themselves would be very unpleasant. However, in so far as the *total situation* ends in public recognition, it is capable of producing keen pleasure.

Conversely, similar relations may be detected between process and unpleasure.

It is important to note that although pleasure and unpleasure are not motives, at the same time they may become powerful *incentives, i.e.*, end-conditions towards which we strive. We begin, quite early in life, to asssociate pleasure and unpleasure with the objects and situations which produce them. If then we have a choice we tend to strive towards pleasure-producing situations, and to avoid unpleasure-producing situations.

THE FUNCTION OF EMOTIONS IN MOTIVATION

The term 'emotion' is used very loosely even in technical psychology and still more so in current speech and literature. It is used sometimes to cover a whole range of feeling-tones. In this book we shall restrict the use of the term to cover *experiences of anger and fear only*, together with the physiological changes which accompany them.

Both anger and fear are distinct from elation-depression and pleasure-unpleasure in that they have no corresponding partner. They do not tend towards a mid-point. Both arise from a zero intensity and increase positively to a maximum intensity.

In both conditions, the individual undergoes extensive physiological changes, particularly associated with the sympathetic

nervous system and the ductless glands. There are changes in rate and depth of breathing, in the pressure and distribution of the blood. The heart beats more quickly, blood is fed to the muscles and certain of the vital organs and withdrawn from others. Sugar (the muscle-food) is fed at an increased rate into the blood-stream. The adrenal glands secrete substances which have a tonic effect upon the heart and muscles, and which increase the tendency of the blood to coagulate.

The physiological effect of anger and fear is *enormously to increase the energy* at the disposal of the creature. This increased energy is then available for aggression or flight according to the demands of the situation.

Psychologically, the effect of anger and fear is to intensify the striving and thereby constrain the angry or fearful individual to put forth and to maintain a maximum effort. Thus they facilitate attempts to overcome opposition or to escape from danger. They play the same rôle in the human mechanism as does the super-charger in an internal-combustion engine.

Anger and fear also are correlated with the course of action. If the behaviour of the individual is leading without hindrance towards satisfaction the emotions are quiescent. If satisfaction is withheld, anger and fear increase in proportion to the degree of opposition or of danger.

The emotions are less important than the feelings in the learning-process. A *mild* degree of anger or fear intensifies effort and attention and therefore to that extent may aid the learner. If a pupil is angry with himself after having made a careless mistake, or after having failed to complete a task successfully, he will be the more inclined to resist making the error again, and will put forward more intense efforts to succeed.

Again, if the pupil is afraid of the consequences of error and failure, he will be the more inclined to work for success.

However, when the emotions pass beyond a mild degree of intensity, they seriously interfere with the poise and efficiency of the person concerned. Anyone who is thoroughly angry, or thoroughly afraid, becomes 'possessed.' He is occupied with but one intention, namely, to destroy the cause of his anger, or fly from what he fears. Past experience fades from consciousness. The critical, reasoning powers of the person are superseded. In the last stage he is a blindly ferocious maniac, or a horror-stricken paralytic.

The thoroughly angry or fearful person reverts to a primitive level of existence. He loses his acquired skills. Even speech fails. His behaviour becomes most definitely anti-social.

In addition, extreme anger and fear are *very expensive of energy.* By the nature of things the angry or fearful person is using up his reserves of energy at a very rapid rate. After a paroxysm of rage or fear the sufferer is left limp and exhausted, and is incapable of further effort until the energy reserves have been replenished.

It is obvious, therefore, that any intense conditions of anger and fear are definitely harmful to the learning-process as well as to the individual himself, and every precaution should be taken to ensure that these emotions are not aroused beyond a mild degree in school conditions.

THE FUNCTION OF IDEAS AND HABITS IN MOTIVATION

Ideas and habits have also been claimed to be sources of motive. Again, this claim seems to be incorrect, since ideas and habits do not in the first place *initiate* striving. They accompany it, and *are developed in the service of the hungers and aversions.*

The function of ideas is (*a*) to direct the striving more effectively, and (*b*) to increase the range and variety of responses by which satisfaction may be achieved.

Through the medium of ideas we can recall previous experiences of striving, the situations involved, and successes or failures. When similar situations occur again we can anticipate the probable course of events, select suitable responses, and reject unsuitable responses. By the association of ideas we can compound simpler into more complex responses. By means of logical analysis we can apply successful responses to novel situations.

By the development of ideas we are able to anticipate future needs, imagine future possibilities, and apply the cumulative experience of the race in order to satisfy those needs and realize the possibilities.

The function of habits is to capitalize successful responses. Under the spur of a persistent hunger we vary our responses when primitive measures fail to bring satisfaction. All new responses are tentative, slow, and inaccurate at first. At each repetition of a *successful* response it becomes swifter, more accurate, more economical of energy, and it requires less and less concentrated attention. By repetition the successful responses become automatic, thus stabilizing the individual's ways of obtaining satisfaction,

and freeing the attentive thinking-processes for newer and more complicated tasks.

Topics for Further Consideration

1. Follow up the discussion of instincts in McDougall's works, *e.g.*, *Social Psychology*, *The Outline of Psychology*, *The Energies of Men*. Summarize his descriptions of human instincts. Compare and contrast his descriptions and explanations of human motives with those developed in the present chapter.

2. Repeat Exercise 1 but substituting Thorndike's account of motives as it is set out in the *Psychology of Learning* (Vol. I).

3. Analyse and record carefully your own experiences and behaviour during a typical behaviour-cycle.

4. Can you describe in your own case any example of a change in the level of complacence. What conditions caused the change? (Note the effects of coming to college as an example.)

Compare notes with friends on this topic.

Exercises

1. Observe carefully the responses of a new-born baby, puppy, or kitten. Record its responses. Keep a record o :the changes in response during the first six months of life.

2. How much 'instinctive' behaviour can be observed in children at 3 years, 7 years, 16 years of age? How much in the normal adult?

3. Note the conditions, in the case of children and adults, in which behaviour approximates to 'instinctive' responses.

4. From your observations in Exercises 2 and 3, discuss the value of the terms 'instinct' and 'instinctive' for a theory of education.

Books for Further Reference

McDougall: *Social Psychology*.
,, *The Outline of Psychology*.
,, *The Energies of Men*.
Burt: *The Young Delinquent*.
Thouless: *Social Psychology*.
Thorndike: *Educational Psychology* (Vol. I).
,, *Educational Psychology*. (Briefer Course.)
Davidson: *A New Interpretation of Herbart's Psychology*.
Watson: *Psychology from the Standpoint of the Behaviourist*.

MURCHISON: *Psychologies of 1925.*
„ *Psychologies of 1930.*
BALLARD: *Handwork as an Educational Medium.*
WATSON: *The Ways of Behaviourism.*
ADAMS: *Primer on Teaching.*
„ *Herbartian Psychology.*
RIVERS: *Instinct and the Unconscious.*
GINSBERG: *The Psychology of Society.*
TROTTER: *Instincts of the Herd in Peace and War.*
DEWEY: *Educational Essays.*
HART: *Psychology of Insanity.*
BERNARD: *Instinct.*
ROSS: *Groundwork of Educational Psychology.*

CHAPTER IV

CLASSIFICATION AND DESCRIPTION OF MOTIVES

In the previous chapter we showed that motivation and interest are connected with processes of regulation by means of which the human organism maintains conditions essential to healthy existence.

Motives assume distinguishable forms—hungers and their corresponding aversions—each hunger and aversion being connected with some biological need.

We find also that learning takes place most effectively under the drive of these hungers and aversions. In the absence of some kind of hunger or aversion no learning occurs.

Now, if the purpose of teaching is to facilitate learning in the most efficient way, it follows that we must be able to harness the energy represented by the drives of hungers and aversions and direct it into educationally and socially useful channels. Our aim all the time should be not to impose facts, figures, and habits upon passive pupils, after the manner of Dickens' famous (or infamous) schoolmasters, Gradgrind and Choakumchild, but to encourage in the pupils active hungers for facts and figures and the various kinds of skill needed by the educated person. If we can do this the actively interested pupil will educate himself. Hence, we must try to find what hungers and aversions are available for the teacher's work in school and everyday life.

For a thoroughly scientific psychology it would be necessary to analyse the complex strivings of living creatures and sort out elementary modes of striving in terms of which all complex behaviour and experience could be expressed. This nicety of analysis is impossible at present simply because methods of analysis of sufficient accuracy and validity have not yet been perfected. Indeed, it is only within the past generation that any adequate *quantitative* methods of factor analysis in psychology have been elaborated. In what follows therefore any classification of hungers will be put forward, not with a view to precise scientific analysis, but for practical professional guidance.

For example, the hunger of most adults for sex-experience is sufficiently specific to be recognized as one mode of striving distinguishable from other modes, such as food-hunger and thirst. It is highly probable, however, that sex-hunger is not an elementary mode of striving but is rather a complex system which includes several more or less closely correlated but at the same time differentiable elementary factors.

For teachers and social workers a convenient classification of hungers may be made with respect to their main reference. Thus we have:

(*a*) A class of hungers having special reference to the maintenance of general bodily well-being and security.

(*b*) A class having special reference to the maintenance of personal status in a physical and social environment.

The hungers in group (*a*) serve to maintain the conditions necessary for physical existence. The more important are:

- Food hunger.
- Thirst.
- Hunger for fresh air.
- Hungers for general bodily well-being and security (*i.e.*, for conditions of optimum stimulation).
- Hunger for *free* physical movement.
- Hungers for excretion.
- Hunger for rest, and sleep.

The more important hungers in group (*b*) are:

- Hunger for companionship (gregariousness).
- Hunger for sex-experience.
- Hunger for self-enhancement.
- Hunger for intellectual free movement (leading to exploration and experiment). This hunger seems to be what is signified by the term 'pure curiosity.'
- Hunger for routine and system.
- Hunger for explanation (that is, for the resolution of novel and mysterious events into terms already familiar).

One item in group (*a*) needs further elaboration. The hungers for general bodily well-being and security form a group all of which are connected *with specific conditions of normal stimulation.* These are the conditions best suited for the security and well-being of the creature. Any considerable departure from these conditions signifies danger. A newly born child will make defence-responses against stimulations of the kind which produce pains in an adult

e.g., pinching, pricking, scalding, burning, irritation of the skin, etc. It also reacts strongly to being tilted or lowered quickly, and to loud, sudden noises. If the reflex defence-responses do not bring satisfaction, and the abnormal conditions continue, the child will strive violently in the attempt to seek the normal comfortable stimulation-level.

As the child grows up, and learns by experience, a great variety of abnormal conditions of stimulation become associated with danger and arouse a hunger for the conditions the child associates with security. Two cases of abnormal under-stimulation are darkness and dead silence. Many adults never lose their aversions to these two conditions.

Also, the hunger for self-enhancement seems to include several distinguishable components, *e.g.*,

Hunger for personal domination—power over other people, over animals, and over the inanimate objects and forces of the physical environment.

Hunger to excel (without domination).

Hunger for perfection.

It is convenient at this point to introduce three new terms.

We have noted that experience presents three elementary qualities:

(*a*) Qualities conveyed by specific sense-organs in vision, hearing, touch, etc. These give rise to perception, imagery, ideas, and the complicated systems of knowledge built upon them. This aspect of experience is known as *cognition*.

(*b*) Qualities of feeling—pleasure-unpleasure, elation-depression, and the complex feelings such as confidence, hope, anxiety, despondency, grief, sorrow, joy, etc. This aspect of experience is called the *affective-tone*, *affection*, or *affect*.

(*c*) Qualities of striving, drive, urge, desire. These are called *conation*. Conation is conscious striving.

Characteristics of Some Hungers commonly observed in Connexion with School Life

In a boarding-school the institution becomes for the time being the home of the pupils. The teachers perform *two* functions. They act as tutors in the normal work of a school, and they act as substitute-parents. Therefore they can control the life of the pupil much more completely, and they are responsible for the satisfaction of the hungers for food, drink, security (out of school-hours), and general well-being. In our discussions we shall be

concerned mainly with the teacher as tutor acting within the normal day-school organization, and only by implication with the teacher acting as substitute-parent (or real parent !).

For this purpose it is desirable to note the characteristics of certain of the hungers which provide the motives directly or indirectly involved in learning in classroom conditions. The hungers in question are :

Hunger for fresh air.
Hunger for conditions of optimum stimulation.
Hunger for physical free movement.
Hunger for rest.
Hunger for companionship.
Hunger for self-enhancement.
Hunger for intellectual free movement.
Hunger for routine and system.
Hunger for explanation.

HUNGER FOR FRESH AIR

If people are confined for some length of time in a badly ventilated room, they begin to show signs of uneasiness, and later of distress. They complain of drowsiness, lassitude, headache, nausea. The outward signs are drooping postures, yawning, slow response, general lack of alertness, and lapses of attention.

These symptoms have been shown to be due to insufficient *fresh air*. Contrary to general opinion the discomfort is due not to deficiency in oxygen, or excess of carbon dioxide, but to increase in temperature and humidity of the *stagnant* air. Flugge, at Breslau (1905), placed some people in an air-tight box. When the atmosphere became oppressive, he allowed them to breathe fresh air from outside the box, through tubes, but found that their discomfort was not reduced. On the other hand, people in the fresh air outside the box who breathed through tubes the vitiated air from inside the box showed no signs of distress.

For optimum comfort and efficiency a *steadily renewed supply* of fresh air at the correct temperature and humidity is required. In rooms heated by coal fires the convection currents set up by the fires maintain a stream of air through the rooms. When central heating is used, the air is apt to become stagnant unless there is a mechanical system of ventilation.

When a class of pupils becomes drowsy, listless, inattentive, and slow to respond to questions or instructions we should first

inspect the temperature and ventilation conditions and make sure that the air in the classroom is fresh. If the ventilation is faulty it is obviously useless to submit the class to a course of five minutes vigorous physical exercise, inside the room, as some teachers do, in order to 'smarten up' the pupils. This practice will merely make the bad conditions worse. It is much more sensible to correct the bad ventilation and *thereby satisfy the pupils' hunger for fresh air.* They will then have more appetite for lessons.

HUNGERS FOR CONDITIONS OF OPTIMUM STIMULATION

These hungers are connected with the maintenance of general physical well-being and security. They are set up by any conditions of over- or under-stimulation. Several types of such conditions frequently occur in school-classrooms, *e.g.*,

Minor ailments—toothache, headache, cuts, abrasions, bruises, *aches caused by badly fitting desks.*

Classroom too hot, or too cold; pupils sitting too near a fire, stove, or radiator; pupils sitting under an open window in cold weather.

Presence of foul, pungent, or acrid smells (as sometimes is the case in a laboratory or in a classroom near a factory or cesspool).

Lighting too intense, *e.g.*, pupils sitting in direct rays of sun; pupils seated so that they look directly towards a window; maps and blackboards 'shining' or situated near a window instead of opposite to it; artificial lights badly placed.

Lighting not strong enough, *e.g.*, pupils sitting in dark corners; blackboard, pictures, maps, specimens too far from pupils to be clearly seen; pupils attempting to read in fading daylight.

Sounds too intense, or conflicting, causing distraction—teacher shouts continuously with harsh, strident voice; teacher's voice too high-pitched; miscellaneous noises outside classroom; too much noisy movement within classroom; teacher stamps or shuffles about unnecessarily while talking.

Sounds not intense enough, or indistinct—teacher's voice weak, or hoarse; teacher 'mumbles'; talks to blackboard and maps instead of to class; talks in unfamiliar accent, or with jerky delivery; *pupils answer questions*

indistinctly, so that remainder of class cannot follow the discussion.

Teacher shows threatening bullying manner, or uses excessive punishment (particularly if liable to sudden unaccountable fits of irritation and temper).

Teachers just beginning their professional work are apt to become immersed in the presentation of their lessons, and to neglect entirely these important classroom-conditions. The more conscientious the teachers, the more frequently does this happen. Then, when the pupils become restless and inattentive, instead of noting the classroom conditions, they redouble their efforts to make their material impressive and thereby intensify the bad conditions. It should be made an invariable practice to ensure that the *pupils are as comfortable and happy in their classroom environment as the classroom arrangements permit.* If a teacher's voice and manner are unfortunate, it is usually possible by practice to improve it. With regard to voice, diction, and delivery the teacher should be as much as possible an artist. Generally speaking, the pupils do not elect to go to school. Their presence is enforced by parents and by the State. When conditions are bad the unfortunate children cannot walk out. They have to sit and bear with their misfortune without the option of criticism or complaint, and they acquire very strong aversions to school, teachers, and work.

It may be objected that if the teacher's manner is unfortunate, his speech indistinct, his blackboard summaries chaotic and illegible, and other pupils' answers inaudible, that the pupils will adjust themselves to these conditions without worrying unduly about the waste of time. This may be true of some pupils. Even so it is not a good argument for maintaining such conditions. In other cases, however, pupils may be conscientious, anxious about passing a test, questioned at home by over-anxious parents who are concerned with their children's future careers. In such cases bad school-conditions can, and frequently do set up anxiety-states in the pupils, making them thoroughly unhappy, reducing their efficiency, and sometimes leading to nervous breakdown.

It is particularly necessary for teachers to maintain a strict supervision of classroom conditions because they themselves are in the most favourable position to make satisfactory adjustments. If there is a nasty cold draught, or an irritating sun-glare, the teacher can remove himself out of it and forget that it still remains. He can always see the blackboard, apparatus, or pictures because

he stands quite near to them. If they are not clear he goes closer. Having thus satisfactorily adjusted himself it is very easy to forget that the pupils are still badly adjusted.

Many pupils associate schools with habitual discomfort, and their aversion to the classroom-conditions spreads, by conditioning, to the subjects of instruction.

HUNGER FOR FREE MOVEMENT

The conditions which set up this hunger are:

(i) Forced movements.

(ii) Continued rigidity of posture.

What is meant by forced movement may be understood by considering the mechanical structure of the body. An arm or leg swinging freely in its socket-joint resembles a compound pendulum. The trunk turning freely to and fro about the waist resembles a balance-wheel. If a pendulum or balance-wheel is allowed to swing freely, it will do so at a natural period (*i.e.*, the time occupied by one complete swing) which is characteristic of it. The period depends upon several factors but mainly upon the length of the pendulum, or the radius of the wheel. If allowed to maintain its natural period the system will continue to move rhythmically and will require a minimum of energy to keep it going. If we try to force the movement at a rate faster or slower than this natural period, much more energy is required, and the system resists the change. It seems as if it were striving to resume its natural rhythm.

Many human movements are rhythmic—swinging arms and legs, turning and bending the trunk, walking, running, skipping, etc. Any of these movements, when made freely, will be found to proceed at a characteristic period *depending upon the body-build of the individual performer.* At this periodic rate, the movement feels most comfortable and can be kept going easily for a considerable time without fatigue. If we attempt to depart from this natural rhythm we have to pay special attention to the movement, and deliberately apply energy very much in excess of the amount required for free movement. So soon as the attention is withdrawn the limbs tend to revert to their natural rhythmic period. To maintain a forced movement is very fatiguing and *irritating,* aversion being rapidly induced. The more the natural period is altered, the greater will be the additional energy required, and the greater the fatigue and aversion.

Individuals of different body-build have different optimum rates of movement. In physical training, gymnastics, games, or using tools a heterogeneous class of pupils cannot be expected to work at exactly the same rates. An average rate of movement will be too fast for some and too slow for others.

The second condition which sets up hunger for free movement is rigidity of posture. It seems to have been assumed by many people that sitting or standing in one position needs no effort. Actually it requires very considerable expenditure of energy, leading to rapid local fatigue, and to strong aversions in the person concerned. From this point of view, the practices of the teacher who was considered a model disciplinarian were thoroughly unsound. It is not good practice to keep classes of pupils standing in a straight line, or sitting bolt upright with arms behind their backs for periods of thirty to forty-five minutes. For young children this is torture. When it is necessary for children to be seated (for an oral lesson, for example), they should be allowed to adjust themselves comfortably at the outset, and allowed reasonable opportunity to change their posture from time to time.

One type of rigidity has already been noted elsewhere—namely, that with which the learner grasps a new tool. This can be noted in any beginner learning to write with a pen, to ride a bicycle, or drive a car. For this reason, the first practice-periods (particularly for young pupils) should be short, and *opportunity for complete relaxation allowed immediately after the practice.*

If the difficulties of forced movement and rigidity of posture are ignored in school the craving for free movement and relaxation will soon *set up conflicts in the pupils' attention-processes* which prevent any effective concentration upon the school-work. In making time-tables, care should be taken that lesson-periods in which there has been forced movement or rigidity should be followed by periods in which change of occupation, or relaxation is possible. When the forced movements involve a restricted set of muscles (as in writing with a pen), a complete change of occupation is as good as a rest. New sets of muscles are then brought into play and the tired muscles relieved from strain. The most effective change is from an occupation involving a restricted set of muscles, to one involving the larger muscle groups of the whole trunk and limbs.

One frequently used classroom-practice needs careful supervision in view of this hunger for free movement and relaxation, that is, the

showing of hands in response to a question. Some students-in-training ask a question of their pupils, and these respond by holding up their hands. The students have probably been warned that they must keep a strict eye upon the lazy members of a class. Therefore they request an answer from some pupil whose hand is down. There may be no answer, or a foolish one. Unwilling to pass this over, they proceed conscientiously to extract an answer from the dumb pupil or to correct the foolish one. During all this time the others dutifully keep up their hands until their shoulders ache with fatigue. If it happens that a correct answer is delayed, and the teacher needs to attend to some individual pupil, the remainder of the class should be asked pleasantly and quietly to put down their hands for the time being. Then at the appropriate time the question can be asked again, and the pupils saved much needless strain and strong aversion.

HUNGER FOR REST

Alternating with the hunger for free movement is the hunger for rest and sleep. The intensity of this hunger varies from one individual to another. It depends also on a person's health and the conditions of growth, more rest being needed during periods of rapid growth.

The hunger is connected with the need for the body to recuperate after periods of active exercise or illness. Continuous driving of the human body, particularly if the expenditure of energy is excessive, is very dangerous. It is necessary to recognize this in dealing with adolescent boys and girls.

Adequate rest and sleep are as necessary for growing children as is food. Some authorities believe that lack of sleep is as potent a cause of poor development as malnutrition, particularly in the case of children living in the over-crowded noisy conditions of large towns. Before reprimanding such children for laziness and inattention in school we need to discover first that the difficulty is not due to a craving for sleep.

HUNGER FOR COMPANIONSHIP

The great majority of the human race are gregarious. They show a strong tendency to herd together. This hunger for the presence of other people is probably associated with security. At the same time it exists in situations where no danger is likely to arise. The desire to be with other people may be quite irrational, *i.e.*, it may serve no useful purpose. Some persons do not wish to co-operate, talk, or play with others. At the same time they feel impelled to mingle with a crowd.

This hunger tends to a mid-point of complacence. We can have too much even of companionship, and most people pass through periods in which there is a more or less definite aversion to crowds and a desire for comparative solitude.[1]

The hunger varies in intensity in different individuals partly owing to the interplay of other interests. The busy craftsman or professional worker, absorbed in his work, feels, at the moment, no hunger for companionship. Nevertheless the hunger appears during periods of relaxation. It is most improbable that the popularity of scientific, educational, and political conferences is due entirely to a pure interest in knowledge and affairs. The social element is also strong.

Feeling-tones are intensified by the presence of a crowd. Pleasure is increased, terror, sorrow, and despair are more intense. We are so made that signs of feeling and emotion in others arouse, directly, experiences of the same feeling and emotion in ourselves. In the presence of a crowd the tendencies to imitate and accept suggestions are particularly strong.

Children appear to pass through characteristic behaviour-phases with respect to gregariousness. The young child shows little tendency for active co-operation. He likes the presence of other people to take the form of a neutral or admiring background for his occupations. A normal child will play happily with his toys by himself for considerable periods while he knows or believes that there are other people within reach. He will be considerably disturbed, however, if he realizes that he is really alone.

Towards the age of eight years (approximately) children develop a much more active interest in other children and in people generally. They show a tendency to form co-operative groups. Team-games and gang-play become popular. The junior-school period (approximately eight to twelve years of age) has been called by some writers the gang-age.

During adolescence, many young people show a marked preference for solitude, or for intimate companionships. This phase passes later into the normal adult's gregariousness.

The hunger for companionship may be turned to good account

[1] Consider the following extract from the journal of a civilian prisoners' camp in 1917: "Only to be out of this crowded desert, just for ten minutes to be on a solitary mountain top . . . anywhere even where danger lies to be away from the sight and sound and smell of mankind and to be able to think one's own thoughts."

in school-work, particularly after the infant-school phase is completed. The heightened pleasure in being with others may be used advantageously by arranging group-work. It is noteworthy in music and dramatics, in fact in any pursuit which involves feeling and emotion.

The fact that in the presence of others, imitation and suggestion are strong, helps in maintaining good class-order and school-tone. Pupils tend to fall into line with the majority. Hence the presence of a group of other children happily at work, is, often, a quite sufficient reason for an individual pupil to join in, and set to work himself. It sometimes happens that a certain pupil does not like the work particularly, but he prefers to do it rather than be left out of the group.

At the same time this hunger to be like and do like other people constitutes a potential danger. It tends to reduce physical and mental activity to the crowd-level of mediocrity, thus acting as a brake upon original thinking and progressive social organization. The schoolmaster's aim must be to exploit the useful aspects of the tendency while discouraging the dangers by promoting free discussion and sane experiments. It is also true that by joining a community with higher standards of living, an individual tends to rise to that level, and *vice versa.*

HUNGERS FOR SELF-ENHANCEMENT

This group of hungers is connected intimately with the maintenance of the individual's position with respect to his physical and social environment. The hungers are satisfied by success, mastery, domination, and excellence. The corresponding aversions are caused by failure, *forced* subordination, inferiority.

The term 'self-enhancement' has been used advisedly. It is awkward, but it signifies an essential factor in the operation of these hungers. They are all forms of self-assertion. The term 'self-assertion,' however, covers rather the 'behaviouristic' aspect of the activity. Coupled with self-assertion in all but the most crude types of activity is an element of *self-valuation.* The mere fact of successful self-assertion may be profoundly unsatisfactory to the person who asserts. The robust schoolboy of twelve years or so may jump over a hurdle a foot high, or spank an 'infant' of seven years. This is evidence of mastery, but it brings no particular elation. *It does not count in the development of his*

personal valuation. On the other hand, to break the school high-jump record or thrash the school bully does produce tremendous elation and vastly increases the self-valuation.

In every aspect of life this group of hungers plays a most influential part. As motives they enter into almost every type of behaviour and purpose. Prestige is, on occasion, a stronger determinant of the national policy of a State than even economic factors.[1] 'Face-saving' seems to be one of the major aims of industrial and political diplomacy. In human sex-relations two *motifs* constantly appear, namely, the wish to possess the loved one exclusively, and the wish to be loved for oneself alone. Again, sex-jealousy contains a strong prestige component. The anger of the jilted or neglected lover arises, not so much from frustration of the satisfaction of sex-hunger, as from the implication that *another person is judged to be superior.* The usual reactions of the rejected lover are either to injure the favoured one, or to achieve some outstanding success in another field. In both cases the reaction is one which confirms the rejected one's personal worth and restores, to some extent at least, the damaged self-valuation. This is aptly illustrated by a case quoted by Burt.

> Harry, a dullard of sixteen, rejected by his youthful sweetheart, goes straight from his wooing and commits his first burglary. "I couldn't get her," he explains, "so I got old Ikey's cashbox."[2]

Many cases of petty delinquency turn out, on examination, to be compensations for damaged self-esteem. When the offender is placed in conditions such that satisfactory adjustment is possible, and the self-valuation thereby established at a higher level, the delinquent tendencies disappear.[3]

Mastery and success of some kind seem indispensable for the building up of strong character and stable personality. Without them self-respect is impossible. They encourage the attitudes of confidence and hope, and are essential elements in true courage. Habitual failure and inferiority produce despondency and despair, choke any positive effort, and end in the disintegration of personality with its accompaniment of mental disease.[4] This principle is of the greatest importance in teaching and school-organization.

[1] *E.g.*, the German demands for colonies after the peace-settlement of 1918. Note also how often Welsh nationalists speak of insults to Wales.

[2] *The Young Delinquent*, p. 451.

[3] See Burt, book cited, pp. 323 and *ff.*

[4] This is one of the social dangers of permanent unemployment.

The hungers for self-enhancement and their corresponding aversions are connected with the need of the living creature to maintain the integrity of its organism in face of environmental difficulty and opposition. In this connexion we can distinguish two aspects of the environment—physical and impersonal; and social. Corresponding with these we can observe two ends for which people strive: (*a*) domination and mastery over physical situations and impersonal difficulties (such as a problem in mathematics) irrespective of the presence of a real or potential audience; and (*b*) a position which, in some respect or other, is a mark of superiority over other people.

The following are some common manifestations of these hungers:

(*a*) (i) Striving for domination, *e.g.*, performance of feats of brute strength which have the effect of bending the environment to one's will.

Manipulating powerful tools, *e.g.*, guns and other weapons, machinery, motor-cars.

Overcoming intellectual problems and moral difficulties.

In this connexion the presence of an audience, or the possibility of recounting the feats to a potential audience enhances the elation and satisfaction, but the striving is directed primarily to mastery of the opposition itself.

(ii) Striving to achieve an impersonal standard of excellence.

The desire to excel may be due in the first place to a desire to surpass one's fellows. With the development of experience and intelligence, however, the complacence-level at which a performer is satisfied rises as ability and confidence increase. The performer then compares his present standard not with that of other people, but with his own previous performances and with a possible future performance which can be envisaged but is not at present realized.[1] What the *ideal* will be depends upon the performer's special aptitudes and training. It may be ideal skill in games or athletics; ideal physical perfection and beauty; designing and constructing an ideal building or a Utopia (an ideal society); achieving ideal moral excellence.

This striving to achieve perfection is the real spur to what is commonly called 'disinterested' effort. As such it should be exploited to the full in any general education.

[1] *Cf.* p. 130.

(b) (i) Striving for domination over people, *e.g.*, political and industrial exploitation (not always due to economic necessity).

Carrying one's point in debate, thus impressing one's own opinion upon other people.

(ii) Striving for public approbation.

This is very often one partial motive for the production of works of art, for making scientific discoveries, for engaging in public work. In fact, it occasionally happens that the actual work is valued by the performer only as a means for securing the social fruits of success—a school pupil passing an examination to secure a publicly awarded prize; or a wealthy adult practising philanthropy to achieve a knighthood (" for public services " as it is phrased in the honours lists).

(iii) Striving for ostentation, *e.g.*, eating off gold plates; wearing more diamonds than anybody else; inventing bizarre fashions;[1] arranging superlatively expensive weddings (and funerals).

In connexion with the hungers for self-enhancement it is important to note that the level at which satisfaction is experienced is represented by a standard which may involve both qualitative and quantitative factors. Thus, satisfaction may depend upon quantitative achievement, *e.g.*, amount of wealth, degree of ostentation, batting average at cricket, etc. On the other hand, the level of satisfaction may be estimated in terms of value. Wealthy people may live simple unostentatious lives because they hold the conviction on rational social or religious grounds that this type of living is socially more valuable and therefore more dignified. Similarly, one may meet a cricketer who is far more satisfied with an innings of fifty runs made without a flaw on a difficult wicket than he would be with an innings of a hundred runs, including several ' flukes,' on an easy wicket.

Thus the level at which complacence is stabilized will depend upon:

The general standards of living, both material and cultural, in the social group with which the individual identifies himself.

The variety of experiences of different social groups and standards of life enjoyed by the individual.

Degree of personal maturity.

Intelligence, *i.e.*, powers of logical analysis and comprehension of rational principles of value.

Quality of self-valuation.

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[1] *Cf.* keeping pigs or tiger-cubs as drawing-room pets.

What makes this group of hungers so pervasive and powerful in personal development is the fact that the complacence-level is, in effect, a *level of aspiration* towards which the individual is strongly, sometimes irresistibly, attracted. A person's 'style' of living is, very largely, the expression of his level of aspiration together with the directions in which the hungers for self-enhancement and their corresponding aversions have been determined by his native aptitudes and environmental opportunities.

The presence of a level of aspiration can be observed in many children at an early age, and it provides a continuous and powerful dynamic factor in their motivation, particularly when the level is skilfully adjusted to their abilities by the teacher. Experimental evidence of this fact will be submitted in the next chapter.

The above indicates a most important indirect educative function of schools and universities. By bringing together pupils and students from different local communities they make comparisons possible, even inevitable, and thus lead to a critical discrimination of values. Further, at their best, they represent a community with broad high standards of excellence to which the complacence-levels of the pupils may approximate. In particular the educative institutions should make available critical constructive guidance enabling the pupils to distinguish the impersonal and ideal standards of excellence from other less worthy standards.

By raising and refining standards of complacence a good school may leaven a whole community.

These hungers for self-enhancement have the two-directional quality. The person who is, or believes himself to be, in a position below his complacence-level will experience an aversion to his present situation and strive to reach the higher position. On the other hand, a person may find himself in a position surpassing his complacence-level. He also will experience an aversion, but will strive to return to the lower level. A young player may perform exceedingly well in a second team and be promoted there and then to the first team. Here the standard of play may be very much higher and the player find himself quite out of his 'class.' The resulting failure is a blow to his self-esteem and may be followed by a strong desire to return to a lower standard. The same difficulty may arise in a too rapid scholastic promotion of a promising but immature pupil. The danger is that the shock

to the pupil's self-esteem may be severe enough to destroy his self-confidence and establish a *permanent* aversion against rising to a higher level. Therefore when any questions of promotion of younger pupils arise, either to a higher grade in academic work, or to a position of responsibility in the school social organization (*e.g.*, house captain, prefect), the staff should be as certain as possible that the pupil will be able to carry on with *at least average success* at the new standard.

The Feeling of Self-abasement

One feeling-tone of considerable importance in school-work is that of self-abasement. It is a component of the complex feelings of awe, humility, gratitude, admiration, and it is invariably present in the attitude of a disciple towards his teacher or master.

During the presence of the feeling-tone the person experiencing it is much more than usually prone to imitate and to accept suggestions from the person admired. Self-abasement is an element in crude faith.[1] Such faith with its tendency towards uncritical subservience has its dangers. Nevertheless, some admixture of self-abasement makes learning easier. A completely self-assured, hyper-critical pupil may be as unprogressive as an unduly subservient pupil. He who criticizes everything believes nothing, and therefore does nothing of a positive nature. He criticizes the good as well as the bad and feels superior to both.

Fortunately, there is a golden mean between undue subservience and undiscerning criticism. The pupil can be encouraged to learn how to discriminate, and at the same time be encouraged to develop self-respect in due proportion. His self-valuation then keeps pace with his power of discrimination, and he will always be *willing to learn* from a proved and trustworthy authority.

Self-abasement is distinguishable from a feeling of mere inferiority.[2] The latter is unpleasant and sets up aversions, whereas self-abasement may be accompanied by deep satisfaction.[3] In self-abasement there is a tendency for the person concerned to *identify his personality with what is contemplated.* That being so,

[1] We may believe because we know that the object of belief is demonstrably true. We may believe without any sort of factual evidence or demonstration being considered necessary. The latter is crude faith.

[2] The reason is that self-abasement implies the presence of a 'sentiment,' whereas inferiority need not. (*Cf.* Chapter XII.).

[3] As in the case of the devout worshipper contemplating the Divinity.

he feels absorbed within the powerful object of contemplation, and, seeming to be a part of it, he shares its might, and satisfies his wish for power or greatness indirectly.

One special set of inferiority-conditions needs careful note, namely, *physical disabilities*. Persons afflicted with lameness, hunchback, deformed limbs, squint, abnormal clumsiness, marked shortness of stature are usually very painfully aware of these disabilities and suffer an agonizing feeling of inferiority. The painful feeling is increased when public notice is attracted by the disability, and particularly when the person is the object of ridicule or contempt.

People afflicted in this way are often irritable, and unduly aggressive.[1] They attempt to compensate for their disability by constant attempts at domination. In some cases the sufferer makes intense efforts to achieve superiority in some form of learning or skill.

Teachers should make it an invariable rule never to call attention to a physical disability which is not the fault of a pupil. Ridicule of any kind is indefensible in such cases. Every effort should be made to render such a pupil happy in his surroundings, and to provide him with opportunities and encouragement to achieve success in directions compatible with the disability.

We now come to a group of hungers of immense importance in intellectual progress. They are :

Hunger for intellectual free movement.
Hunger for routine and system.
Hunger for explanation.

HUNGER FOR INTELLECTUAL FREE MOVEMENT

This hunger leads to what might be called adventures in ideas. It is a spur for practical experiment, theoretical speculation, and æsthetic creation. It is obvious that much scientific investigation as well as literary and other artistic activity is carried on in the direct service of other hungers. This will be appreciated if we attempt to discard all the work and knowledge connected with the production and distribution of food, water (in some form or other), and clothing ; the organization of efficient conditions of shelter, protection, warmth, coolness, ventilation, light, cleanliness, and sanitation ; the production of materials for adornment and

[1] One potent cause of behaviour-problems during puberty.

aids to beauty; provision of opportunity for physical exercise and amusement, both individual and social; and the satisfaction of sex-hunger.

However, after we have made due allowance for all this directly or indirectly *useful* work and knowledge, there remains a highly significant residuum which owes little if anything to immediate or even ultimate utility. This residuum is motivated by an urge to experience something new—what may be called 'pure curiosity.' This striving to encompass the unknown is admirably described in the well-known passage from St Paul's adventures in Athens.[1]

> Then certain philosophers of the Epicureans, and of the Stoics encountered him. And some said, "What will this babbler say?"[2] Others said, "He seemeth to be a setter forth of strange gods." And they took him and brought him unto Areopagus saying, "May we know what this new doctrine, whereof thou speakest, is? For thou bringest certain strange things to our ears; we would know therefore what these things mean." (For all the Athenians and strangers which were there, *spent their time in nothing else but either to tell, or to hear some new thing.*)

The Apostle being thus invited, began by saying, "As I passed by and beheld your devotions I found an altar with this inscription—TO THE UNKNOWN GOD."

This hunger for new experience *for its own sake* is strongest when all other needs are satisfied, that is, in times of peace, prosperity, and security. Also it bears a definite relation to the degree of intelligence of the individual who shows it. One of the most distressing features, from the teacher's point of view, of backward and mentally deficient children is the very low degree of this curiosity which they show. So soon as their primitive animal wants are satisfied they lapse into complacent lethargy. The hunger is particularly characteristic of normal children between the second and the sixth or seventh years, during the period when the world is new to their developing intelligence. Some people show a persistent hunger for new experience throughout life. Speaking of Sir Francis Galton, a recent writer says:

> In his wealth of novel ideas he is indeed without a parallel in the whole of modern psychology; but his genius was of a roving rather than a persevering order. His insatiable curiosity constantly attracted

[1] Acts of the Apostles, Chapter xvii, verses 18–23. (The italics are mine.)

[2] Note the obvious implication of intellectual superiority in the natives over the foreigner. (*Cf.* Hunger for Self-enhancement.)

him to new problems, to each of which in turn he brought to bear his characteristic energy, originality, and courage. . . . From fashions to finger-prints, from the geographical distribution of female beauty to the application of statistics to prize-giving, from weight-lifting to the future of the race, nothing lacked interest to this ingenious, versatile, and all enquiring mind.[1]

In the majority, unfortunately, the appetite for new knowledge is beginning to abate by the time they reach the senior elementary, or the secondary school, partly because their hunger has been satisfied—they know enough for their immediate needs—more particularly because the schools have been very slow in studying and discovering ways of encouraging this extremely valuable hunger. If we may use such an analogy, the schools have specialized in supplying chaff instead of bread!

Nevertheless, the hunger does persist to some degree in a majority of people, and can be developed by the use of suitable incentives. It is important to note that the most powerful incentive is *not the unknown, but the partially known.* If the presented situation be absolutely novel, it will be passed by unnoted, for the simple reason that it will not be connected in any way with the observer's past or present experiences.[2] The possibility of producing new species of grasses which shall be more palatable, more nutritive, earlier to appear in spring, faster to grow and later to cease growing, is not a problem for sheep although it concerns them closely. It is not a problem to a townsman on a country walk. He believes there is only one kind of grass and therefore does not envisage the possibility of rearing others. It is a problem and therefore an incentive to the scientific agriculturist who *has noted varieties of grasses* and who begins to wonder at their variety and how they arise, and who realizes that some are more prolific than others.

Before a situation arouses this intellectual curiosity we need to possess some knowledge relevant to it and to suspect there is other possible knowledge not yet discovered.

A simple example is afforded by observation of a loose end of a rope. If we walk alongside a high wall and see a rope-end dangling over it we experience a strong tendency to follow the rope visually. We infer the existence of the remainder of the rope, but cannot verify

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[1] J. C. Flugel, *A Hundred Years of Psychology*, p. 126.

[2] *Cf.* Chapter VI.

the inference directly. *The tendency to follow the rope visually is checked before the conation is satisfied.* Then we adopt a questioning attitude and wonder what is on the other side, and feel a desire to look over the wall to find out.

Any departure from a normal expected sequence of events, any real or apparent contradictions are occasions for the display of this hunger.[1]

HUNGER FOR ROUTINE AND SYSTEM

When we have gathered more unrelated experiences than we can comprehend together we begin to feel some aversion to further exploration. We want a system. We desire to group the experiences into some sort of order which can be grasped easily and used with a feeling of mastery. Having made a system both in our ideas and our material environment, we can reduce thinking and behaviour to a routine which represents a condition of least action.

Hunger for routine may be observed quite early in child-development. Young children insist on being dressed in a prescribed way. Their games must be played strictly according to a formula. Stories must conform strictly to the letter of the originals.

In adults we find a strong aversion to a haphazard, constantly shifting environment. Such a condition demands continuous alertness. It sets up conflicts in the attention-process. It is extremely tiring and consequently very unpleasant. We begin to experience a hunger for rest and peace. So soon as we find ourselves in a state of chaos, we set about creating a stable system. This applies to political and religious beliefs as well as to office and school-management.

This desire for routine and system seems to be connected with (*a*) the tendency of any physical system to adjust itself so that there is the least possible expenditure of energy, (*b*) the increasing facility which habit gives to performance, (*c*) the hunger for mastery and domination.

What we can do easily and skilfully gives us the feeling of mastery and satisfies that hunger. This fact constitutes a danger to progressive learning. We prefer the first routines which satisfy our needs. To depart from them promises disorder, unpleasantness, and a feeling of inferiority which we desire to avoid. For progressive learning we must steer a middle way between chaos and complete systematization.

[1] See N. Isaacs' appendix on *Epistemic Questions* in *Intellectual Growth of Young Children*.

This tendency to cling to habits which, while relatively inefficient, are easy to acquire at first and therefore bring premature complacence is important for teachers of technical processes (*e.g.*, shorthand, typewriting, playing a musical instrument). It is very desirable to train the pupils from the outset in efficient methods before they have developed the inefficient habits. Too early complacence is thereby prevented and there is not the same distressing tendency for the pupils to resist further training.

HUNGER FOR EXPLANATION

This is a variant of the hunger for routine and system. It arises whenever we experience an event, or receive an idea which does not fit into its environment. A novel experience disturbs our system of habits and beliefs. We seek to incorporate the novel event within our established systems. When the novel event can be restated in terms of already familiar experience it is thereby 'explained' and we are satisfied.

The completeness of the explanation varies with the intelligence and knowledge of the observer. The small child will accept any likely analogy as a sufficient explanation, *e.g.*, the moon is a glass globe with an electric bulb inside it. The scientific worker is more exacting. He demands that the novel experience shall be *demonstrated logically* to be a particular case of an already established general law (*e.g.*, Newton's explanation of the motion of the moon). In both cases, achieving the explanation brings great satisfaction.

Here again the hunger for system and explanation is so strong that even well-educated people are constrained to adopt, *and cling to*, the first hypothesis or the easiest hypothesis which appears in any way to fit the case. Thereupon, the satisfaction aroused by the relief of unpleasant tension, and by securing an apparently sound foundation for belief and action, is so intense that not only is further research and analysis stopped, but *it may be resisted altogether* by the interested parties. This is a common occurrence even in scientific research.

Some Subsidiary Principles of Motivation

Having differentiated and described the characteristics of the hungers of most importance in teaching and school-organization, we must now take note of certain subsidiary principles which govern the working and interaction of these hungers.

I. SUBSTITUTE-SATISFACTION OF HUNGERS—SUBLIMATION

It may happen that *direct* satisfaction of a hunger is prevented by social conditions. It is necessary to consider how *substitute-satisfaction* may be possible.

Such satisfaction is desirable, since the hungers represent a flow of energy directed towards the means of satisfaction. This energy arises from physiological processes within the organism, and it resembles a flow of energy in any physical system. In particular it obeys the law of conservation. This implies that the energy *cannot be destroyed*. It may be dissipated and, from the point of view of useful work, wasted. It may also be directed from its normal course into alternative channels.

Young children crave for mastery over their environment. This latter, however, has been organized mainly for the convenience of full-grown adults. Consequently, the child's small stature, limited strength, and crude skill are quite inadequate to enable him to behave towards his environment as adults can. Since the adult's behaviour signifies mastery to the child, he craves to behave like an adult but cannot obtain *direct* satisfaction for his craving.

The hunger for free movement is very strong in children. They want to run, jump, dance, throw stones, shout, and so forth. But any direct satisfaction of this hunger may be extremely inconvenient in a well-organized [1] and expensively furnished house, garden, or school.

Hunger for sex-experience is strong in later adolescence. Direct satisfaction of this hunger is impossible in normal civilized economic and social conditions. Premature and promiscuous sexual intercourse lead to consequences which the community in general finds intolerable.

These three examples have been chosen because they frequently occur in everyday educational and social conditions. They are, however, only typical of many other situations in ordinary life. The problem now arises—what should be done when circumstances make impossible or socially intolerable the direct satisfaction of a hunger.

The first response of an unreflective adult community (*i.e.*, parents, teachers, elders of the Church, local government authorities) is to ignore the hunger and assume that it is not a fact. Ignoring the hunger, however, does not remove it. Sooner or later, it may be manifested in grossly anti-social behaviour. This is then met by prohibitions enforced by punishment.

[1] Well-organized, that is, from the adult point of view.

Prohibition and punishment do not remove the hunger. Aversion from the punishment may be strong enough temporarily to prevent any *direct* satisfaction, but it has the effect of 'bottling up' the energy at the service of the hunger, *making the craving for satisfaction even more intense.* The repressed energy will then force outlets in the form of *substitute-satisfactions.*

If we will bear in mind that we are using an analogy and not stating a fact, it is convenient to compare the repression of the satisfaction of a hunger with the damming up of a stream of running water. The energy of the stream is not destroyed by the dam, although the normal *course* of the stream is stopped. The energy accumulates behind the dam. To maintain the stoppage, the dam must be made continually bigger and stronger. Even so, the water will finally overflow in some other direction, or make for itself devious subterranean outlets. Hence, in building dams, engineers invariably provide controlled channels through which the water may escape, and, in so doing, they can often *use its accumulated energy in useful work.* Or they provide some means of escape which though economically useless, is at the same time harmless.

This analogy is useful, for it suggests that the teacher and social worker can apply the engineers' principles to the control of human behaviour. Substitute-satisfactions may take various forms. Some of these are socially undesirable; some even may be secret and dangerous perversions. At the same time, others are socially harmless, and still others may be personally and socially useful.

Consider the examples cited. The young child craves for mastery over his environment. His very immaturity effectively prevents his mastery in an environment designed for adults. The child may seek a substitute-satisfaction in *day-dreaming.* He imagines what he will do when he grows up. He dreams himself into a kind of fairyland in which his craving for mastery would be satisfied. This is one form of secret, 'subterranean' outlet for the hunger-energy. It is socially harmless, but may be personally dangerous. The child's fairyland may be, in fact usually is, a very distorted version of the actual reality he will meet when he does grow up. His day-dreams may not issue in action at all. Therefore he will derive from them no adequate training for the future. Further, the day-dreams may be so seductive that the dreamer gets into the habit of seeking his satisfaction in them and retreating from the reality when he finds it difficult in some respect.

In a reflective progressive community, the child's craving for mastery is acknowledged. In this case, realizing that full direct

satisfaction is physically impossible, and that day-dreaming is a not altogether desirable substitute, the adults endeavour to create an artificial environment *which will provide a substitute-satisfaction and at the same time guide the hunger energy into socially useful channels.* In other words, the child's physical environment is reduced in scale so that he can effectively master it. In the modern infant school-room we find miniature armchairs and tables. There are real pegs for hats, coats, and school-bags, but they are placed within easy reach of the child's arms. There are real cupboards, but low enough for infants to use without the indignity of having to be lifted by an adult, or having to stand on tiptoe on a chair.

In this miniature environment the child does not obtain full and direct satisfaction for his craving for mastery. He is not yet an adult, and he is not dealing with the adult's environment. Nevertheless, in his miniature environment he can behave *as if he were an adult,* and since the two environments are similar, the child in mastering his miniature environment is learning *valuable habits of social skill which will be applicable in the real adult environment later.* A well-conducted modern nursery-school approximates very closely to a miniature social system in which the adults present play only an unobtrusive rôle. The feature of such schools most frequently noted by lay observers is the dignity of the young persons who make up the community and the serious way in which they carry out their miniature social responsibilities. *They have achieved the status of persons.*

The child in the dead-silent classroom of the orthodox school seeks satisfaction for his hunger for free movement in day-dreams. That means that his attention is diverted from the school-work. In addition he becomes fidgety and irritable under the irksome restraint and this leads to difficulties of class-order. Indiscipline is always liable to break out. Moreover, the child develops a strong aversion from the school and school-work and strives to avoid it.

In modern educational practice systematic attempts have been made to harness the energy of the hunger for free movement *by making the school-work itself a source of substitute-satisfaction. School-subjects are presented as activities.* Familiar examples are practical manipulation and measurement in arithmetic and geometry ; experimental science ; gardening ; field work in botany, zoology, geography ; dramatization in literature ; constructive art and craft work ; physical training, dancing, eurhythmics, organized games. (*Cf.* p. 44).

It should be noted that these subject-activities do not all provide *direct* satisfactions for the hunger for *free* movement. Measurements, experiments with scientific apparatus, constructive art and handwork, physical training, and even organized games have to be carried out according to definite rules and with instruments or tools which impose their own restrictions upon the operators. Hence any formal instruction and practice in these activities must not be undertaken too soon in the child's school life; and no matter how full of *organized* activity and games the school programme may be, some time must be allowed for each pupil during which he is as free as possible from any artificial restriction on his natural movements and rhythms. In this respect probably the most directly satisfying school-activities are eurhythmics and informal dramatization. In these the pupil imposes his own interpretation upon the music or words.[1]

Nevertheless, the subject-activities mentioned in the previous paragraph do provide controlled channels for the expenditure of the energy of free movement and make a very good substitute for direct satisfaction. In the light of this principle of substitute-satisfaction we can appreciate more fully Dr Ballard's assertion [2] that where handwork has been introduced into the curriculum, problems of class-order disappear and the pupils' whole attitude towards the school and school-work is changed.

The adolescent's 'subterranean' outlet for the energy of sex-hunger is erotic day-dreaming and various forms of self-abuse. These substitute-satisfactions are both personally and socially undesirable. Several types of healthy substitute-satisfaction are available. We may note the study of romantic literature; the presentation of stage-plays, particularly tragedies, in which the 'love-interest' is shown in relation to wider problems of social life; sane discussion of sex-problems; study of reproductive processes in scientific biology; attempts by pupils at creative work in art and craft; dancing; 'mixed' games, such as tennis and badminton; organized social functions in which members of both sexes take part. By participating in these activities adolescents not only find substitute-satisfactions for sex-hunger, but they may also learn something of the courtesies and responsibilities which will be indispensable in their adult lives.

[1] There are also percussion bands for young children and country dancing for everybody.

[2] See *Handwork as an Educational Medium*.

The concepts of energy-flow and substitute-satisfaction are fundamental in psycho-analytic literature. There the energy represented by the various hungers is called 'libido,' and when energy is diverted from the normal course of direct satisfaction into channels of substitute-satisfaction it is said to be *sublimated*. The concept of sublimation is most important in social development (see Chapter XII).

This principle of substitute-satisfactions raises a point of great importance in general social education. The school must fulfil a wider social function than that of providing academic *instruction* in subject-matter and professional skill only. It is essential that the school shall organize, in addition, a variety of healthy satisfactions and make those pleasures habitual. The more the pupils find interest in literature, science, arts and crafts, music and dancing, dramatics, organized games, the less will they be inclined to seek satisfaction in the cruder pleasures of eating, drinking, sex, and personal domination by brute strength. Particularly does the school owe this duty to those pupils whose home-life is drab and restricted. Education in substitute-satisfactions is essential for the growth of well-balanced personalities and stable social organization. This seems to be the essential significance of 'education for leisure.'

II. MUTUAL INTERACTION OF HUNGERS

We have discussed distinguishable hungers as if they acted in isolation. In actual life this is never the case. There we find, always, *some person who experiences* more or less clearly recognizable hungers.

Occasionally we are not quite clear about what kind of a hunger it is that we experience. It is possible to feel a vague restlessness, an indeterminate want or aversion. We cannot locate the source of it, nor determine what exactly we wish to do about it. We just feel a mild wish to do something.

However, when the conation becomes definite and we realize what we are hungry for, the hunger does not operate in isolation. It is influenced by the general condition of the organism and by other hungers which may be more or less active at the same time. In this way, human motive is almost invariably complex. This fact has certain important implications for the teacher.

When a hunger is active it controls for the time being the

interest of the person and makes him prone to attend only to those signs in the situation connected with the satisfaction of the hunger. We may ask, therefore, what is likely to happen when two or more hungers are active simultaneously. Two alternatives are possible: (*a*) the hungers will co-operate and reinforce the motive; (*b*) the hungers will conflict, thereby competing for control of the attention-process, and the use of habit systems and ideas. The connexion of these two alternatives with interest and success in school-work is obvious.

Hungers co-operate and reinforce motive

Consider a food-hungry child who is averse to darkness. Suppose he is about nine or ten years old and his hunger for self-enhancement is strong. The food he desires may be in a dark pantry, at night. His food-hunger drives him towards the dark pantry. His aversion from darkness keeps him away. He oscillates between going and staying away. At the same time he wants to think of himself as strong, brave, and manly. He is averse to weakness and cowardice. The two motives food-hunger and hunger for self-enhancement reinforce each other and together may be stronger than the aversion to darkness. Then, although the boy may go with a shudder, and return in an undignified hurry, nevertheless he does go to get the food, and satisfaction in eating is intensified by the satisfaction of his hunger for self-enhancement. He has proved his courage in the act of getting food.

This principle is important in that some school-work is both necessary, and at the same time inherently uninteresting to some pupils. The teacher must seek to induce his pupils to attack this kind of school-work by arranging conditions so that several partial motives in favour of the work are compounded together, finally becoming strong enough to overcome the aversion against the work.

Conversely, of course, two or more aversions may be compounded to overcome an undesirable hunger.

Hungers may conflict and dissipate motive

In this case an oscillating indecisive behaviour ensues until either the individual is exhausted or one hunger becomes so intense that it takes priority over the other and thus determines the conflict in its favour.

Consider the food-hungry child at the age of about three years,

before the desire to be considered manly has been well differentiated. He may approach the dark place. As he gets nearer, his aversion to darkness increases till it is stronger than the food-hunger and he retreats.[1] As he retreats, his hunger for security is temporarily satisfied and the food-hunger takes control. Again he approaches the dark place. If the child is intelligent and circumstances are favourable he may resolve the conflict satisfactorily by varying his methods. He may take a light into the pantry. He thus removes his aversion to the darkness, and makes it possible to satisfy his food-hunger also. He may persuade an older person to go with him. If he is very intelligent he will persuade the older person to go and get the food for him.

This competition for the attention-process is always liable to arise in pupils during school-hours. The teacher's problem is not to make the pupils interested. It is to ensure that they shall be *so much more interested in school-work than in outside pursuits* that they will spontaneously attend to the school-work. Further, having induced the pupils to attend, the teacher must be careful not to allow other conflicts for attention to arise until the work in hand is completed.

III. ORDER OF PRIORITY OF HUNGERS

It is important to note an approximate order of priority of the hungers. Those of our first group (p. 75) will claim priority, in case of conflict, over the hungers in the second group. Of those in the first group, the hungers for food, drink, fresh air, and excretion will claim priority over the others in the same group, if a conflict is continued to extreme limits. These basic hungers are essential for the immediate welfare of the creature.

This order of priority bears directly upon problems of interest-control and class-order. In most schools as they are at present constituted, the subject-matter of instruction directly or indirectly satisfies the hungers in group (*b*). The pupils in school, however, cannot be separated from the same pupils as they exist out-of-school. They are not intellectual abstractions, or machines for registering dates and formulæ, and performing habits of reading, writing, and calculating. The effects of the pupils' social and economic circumstances will be carried into the classroom.

Now suppose, as is only too frequently the case in distressed

[1] *Cf.* the timid adult with a toothache trying to decide to go to the dentist.

areas, that pupils are ill-nourished ; insufficiently clad ; verminous ; or suffering from some minor but distressing ailments. Pupils may be tired, due to insufficient sleep in over-crowded living conditions, or having to work at home ; or (as in some rural areas) travelling long distances to school. Some pupils may be anxious for their immediate security. They may have been threatened with a 'hiding' by an irate parent or older pupil. On the other hand some pupils may have been fed unwisely and too well. They have stomach-aches and feel sick.

These conditions will set up primary hungers and aversions which will control the pupils' attention-adjustments to the exclusion of school-work. If the teacher attempts to force the attention of these pupils, instead of achieving his aim he merely makes things worse by adding further basic aversions to reinforce those already working against school-interest.

Fatigue due to a hard day's work frequently prevents evening-school students and adults in extra-mural (University Extension, or Workers' Educational Association) classes from concentrating their attention upon their studies. Such students crave sleep.

Before such pupils are capable of paying adequate attention to their school-work they must have their primary hungers and aversions satisfied. They must be adequately fed, reasonably clean, sufficiently clothed and rested, and free from minor ailments. They must also be comfortable and secure in school.

The power of primary hungers to control the attention-process has not met with sufficient recognition, partly because teachers and education authorities generally belong to the more fortunate section of society whose lives are well ordered. They seldom, if ever, find themselves in conditions of extreme privation.

The effect of constant hunger and great muscular exertion is well described by Major Priestley.[1] He says that the diet of a man-hauling sledge party in Polar exploration " leaves the party with a craving which nothing can allay but the next meal, and that, but for all too short a time. The effect of this hunger upon the waking mind is to *concentrate the thoughts upon every variety of savoury food that the individual has known*. Its effect in sleep is to *lead to a succession of food dreams* which carry the dreamer from one paradise of the gourmand to another until he awakes to find the craving for food almost unbearable. The normally constituted party talk food, think food, dream food." [2]

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[1] " The Psychology of Exploration," *Psyche*, Vol. II, No. 1, 1921. (The italics are mine.)

[2] See also Koestler, *A Spanish Testament*.

Unfortunately, the teacher has no direct control over the satisfaction of these hungers. That depends upon the condition of parents, upon the general economic conditions and social conscience of the community. It has slowly dawned upon successive governments and public education authorities that any kind of organized instruction is merely an expensive waste of time and money unless the pupils are in a fit condition to concentrate upon their studies. Hence, in spite of many vociferous protests from vested interests of all kinds, education authorities now make some attempts at least to supplement the distressed pupils' food and clothing; to provide adequate school-buildings and furniture; to maintain a system of medical inspection, and treatment for dental and other minor ailments. Also children are prevented by law from undue employment out-of-school; protected from serious neglect or harsh treatment by parents; and, when schools are re-organized, transported at public expense to and from school.

One rather frequent cause of exploitation is often forgotten, namely, the custom of expecting girls of school-age to do more than their share of the domestic work of the house. Many girls, even in secondary schools, are unpaid domestic servants as well as school-pupils.

Those classroom-conditions listed on p. 78 will arouse primary hungers which compete successfully for the attention-processes and thereby interfere with a pupil's progress. In such conditions pupils strive to escape instead of striving to master the work, and no matter how the teacher may threaten or persevere the aversions will win in the end. Some of these bad conditions are due to poor buildings and equipment and are beyond the teacher's immediate control. Others, however, depend directly upon the teacher himself and can be remedied.

Exercises

1. Analyse your own motives in such cases as the following:
   (*a*) Choosing your favourite subject.
   (*b*) Choosing a profession.
   (*c*) Attending a particular lecture.
   (*d*) Going (or not going) to church on Sundays.
   (*e*) Studying a 'dry' subject instead of idling (or not doing so as the case may be).
   (*f*) Putting on your best clothes to go to a dance.

Compare notes about the same topics with other people.

How far are your statements real reasons, or merely excuses ?

2. Study some cases of combination and conflict of motives both in literary examples (novels, biography, drama) and in real life.

3. Students of literature may consider how far 'tragedy' is the portrayal of an irresolvable conflict of hungers within a personality. (Cf. *Kristin Lavransdatter*, *Gone with the Wind*, *Hamlet*.)

4. Follow up the concept of conflict of hungers and consequent competition for the attention-processes by studying the conditions which lead to lapses of memory, and the causes of insanity. (See, for example, Hart, *The Psychology of Insanity*.)

5. Collect examples of sublimation both in school and in social affairs.

How far can war be avoided by organized sublimation of the hunger for mastery ?

6. Note actual examples in school-pupils and fellow-students of each of the hungers (and the corresponding aversions) listed in this chapter.

7. Compare this classification and description of hungers with McDougall's list of "primary instincts" and Thorndike's "original satisfyers and annoyers."

Books for Further Reference

See Bibliographies at ends of Chapters III and V.

CHAPTER V

ORGANIZING INTEREST IN SCHOOL-WORK

We have now to consider how the principles of motivation set forth in the two previous chapters can be applied in the practical work of organizing interest. The principles are quite general. They apply to children of various ages as well as to adults, and can be used in social and industrial problems as well as in normal teaching. Here we must restrict the discussion more particularly to the problems of teachers in junior and post-primary schools. The section on motivation of monotonous repetitive work is important for teachers of technical subjects involving a high degree of skill.

Before discussing practical procedures in detail we must glance at one or two preliminary problems.

What is Interest?

In the psychological meaning of the term, interest is a condition of a living creature when experiencing a hunger or aversion.

Interest is revealed in *consciousness* as feelings of urge, drive, desire, appetite, craving, and wonder. When we are interested, the object of interest is felt to concern us, to have a value for us, to be worth striving for.

Interest is revealed in *behaviour* by such signs as the following:

Tense, eager alertness.

Readiness to act.

Anticipation of the next phase of a developing situation. (*Cf.* animal hunting its prey.)

Persistent effort towards a given end-point with varying means.

Actions which indicate impatience and irritation when the end-situation is delayed.

Teachers need to observe children and note carefully the external signs of interest (and of its absence!). The external signs are indications of the pupils' inner condition.

Ought We to make School-work Interesting?

So far we have taken for granted that it is desirable to make school-work interesting. This assumption is by no means universally

accepted. It is said that " the play-way boy makes the work-shy man " and " to teach children through interest is to lead them along the broad and easy path of self-indulgence." The real objection behind these views is that teaching through interest is not conducive to either intellectual or moral discipline, for which some measure of difficulty and persistent effort are essential.

The fallacy in these objections to what is called " soft pedagogy " consists in identifying interest with self-gratification. The people making them have failed to distinguish between *interest* and *interests*.

Interest is the *subjective feeling of value* which we experience when striving. This feeling implies some end-point, an object or situation in which we are interested, and for which we strive. Such objects or situations are the interests.

Now we can distinguish between two broad classes of interests : (*a*) those in which the objective sought is some form of self-gratification ; and (*b*) objectives other than self-gratification. This distinction may be seen in the case of food-interest. If we are food-hungry the primary objective is the food itself. The pleasure in eating is incidental, serving merely to prolong the process of eating until sufficient food has been eaten. However, some kinds of food are more pleasant than others. By reason of our intellectual equipment we can distinguish the pleasure of eating from the process of eating itself. Then we tend to establish a scale of pleasures, and the pleasure to be derived from some kinds of food may become the primary object of eating, the food itself becoming incidental. We may eat, that is to say, merely to secure delightful perceptions of taste and smell.

Eating for self-gratification may become a real danger. It is a well-known fact that we become adapted (*i.e.*, complacent) to a given degree of pleasure. Thereupon we cease to feel pleasure. The stimulation has lost its ' kick ' as we say in our elegant modern phraseology. Therefore if our objective is self-gratification we seek ever more intense forms of pleasure. This constitutes the danger, since, *if we choose our food for its pleasure-producing qualities only, it soon ceases to have any due relation to the primary needs of the body as a whole.* The food-hunger is perverted. At its logical (or illogical) extreme the process ends in the eater trying to subsist on Worcester Sauce and jam. This inevitably ends in digestive disorders, disease, and loss of physical and social efficiency.

The objections to systematic self-gratification are evident.

The process has *moral* and *social* implications. The physical degeneration which inevitably follows systematic self-gratification offends our ideal of what a healthy individual should be. In the second place, the unhealthy and degenerate person is economically inefficient and becomes a liability to his family and the community. Other people, as well as himself, suffer from the unfortunate consequences of his self-gratification.

What is true of food-hunger is equally true of all the other hungers. Therefore there is a very good ground for the objections to interests of self-gratification. However, so soon as we realize the fact that some interests (what we may call objective interests) do not involve self-gratification, the objections against teaching through interest break down.

By teaching through interest we shall mean here encouraging objective interests in the pupils. This process is not only quite compatible with moral and intellectual discipline but inseparable from it. We shall see later that difficulty itself is quite often a strong incentive to persistent effort.

Educationally, the most valuable interests are those which involve creating things. It matters little (from an *educational* point of view) whether the thing made is a drawing, a toy, a working model, literary composition, scientific hypothesis or moral character. Even making money is better than making nothing at all. What is actually made will depend on the intelligence, skill, maturity, inclination, and training of the person concerned. The educational importance lies in the striving to create something, the effort put into the making, and the gains in knowledge and skill which result from the process.

Promoting Interest eliminates Drudgery but not Hard Work

By drudgery is meant monotonous work performed under external compulsion, when the worker has no realization of the ends to be achieved by it. It has, therefore, no value for the worker and produces strong aversions.

Actually, drudgery is the most fertile cause of self-gratification. Life without some degree of pleasure is intolerable for human beings. If the pleasure is not attainable through constructive intellectual or physical work it will inevitably be sought in self-gratification. It is common knowledge—out of school at least—that the happiest people, and the people least prone to seek

self-gratification, are those who have clearly realized objective and constructive interests in life. On the other hand, people without such interests are prone to nervous and physical disorders, and all kinds of perversions. Self-gratification of some kind is their only hope of satisfaction.

When interest in some constructive end is present, much monotonous and tiresome work will be undertaken with vigour, *without external compulsion,* because the end in view is valued by the learner, and the connexion between work and end is clearly realized.

Immediate and Mediate Interest

Actually there are not several kinds of interest but it is convenient for teaching-purposes to note two ways in which objects and situations (including school-subjects) may become interesting:

(*a*) Interest may arise because the object or situation is the appropriate means of satisfying a hunger, *e.g.*, food is interesting to the food-hungry person. In this case the interest is said to be *immediate* or *direct.*

(*b*) Interest may arise because the object or situation has been associated with a directly interesting experience, *e.g.*, a restaurant-sign may be, in itself, a perfectly indifferent object, but it becomes interesting to a food-hungry person because of its probable association with food. In this case the interest is said to be *mediate, indirect,* or *derived.*

Practical Procedures for organizing Interest

We can best begin our main discussion by summarizing the conditions of interest, namely:

We deal in Practice with a Person who is interested

It is essential to keep this apparently obvious but frequently forgotten fact clearly in view in all our thinking about interest. In psychological discussion we have to consider interest and attention as abstractions, but in actual life they are *always functions of the person as a whole.* From this fact follow certain important corollaries:

Interest will be determined not only by conditions at the moment in school, but also by conditions of the pupils' out-of-school lives, by their previous life-histories, and by their native endowments.

Hungers may co-operate and reinforce interest.

Hungers may conflict and cancel out interest. In this case certain hungers will claim priority over others in the competition for the available attention-adjustments, action-systems, physical and mental energy.

If direct satisfactions are not available the interested person will seek and accept substitute-satisfactions.

Interest will spread by subconscious 'conditioning,' and by conscious association, from directly interesting objects or situations to otherwise indifferent details which may happen to be connected with them.

Ideas and the motor mechanisms of action are developed in the service of the hungers. This is equivalent to saying that knowledge and skill are accumulated in the course of satisfying hungers or removing aversions. In the absence of any kind of hunger or aversion, knowledge and skill have neither value nor meaning.

Direction of Striving

We strive for any object or situation which seems likely to satisfy a hunger, or remove an aversion, either directly or indirectly.

We are complacent towards and tend to ignore:

- Any object or situation not connected directly or by association with satisfying a hunger, or removing an aversion.
- Any situation in which a hunger has been satisfied for the time being.
- Any situation which remains constant and shows no likelihood of developing (*cf.* monotonous repetitive tasks, monotonous conditions of stimulation, 'plateau-periods').

We are averse to and strive to avoid:

- Conditions of over- and under-stimulation.
- Conditions of over- and under-satisfaction.
- Conditions of constraint in which we are *forced* to maintain a period of rest or activity unduly.

Practical Procedures Classified

We can now make a convenient classification of the practical procedures available for organizing interest in school-work. They are:

- Removing aversions by organizing suitable conditions in school and classroom.

Selection of subject-matter and educational activities which will provide either direct or substitute-satisfaction for hungers.

Skilful presentation of subject-matter and arrangement of exercises for practice.

Organizing incentives when work is intrinsically uninteresting.

REMOVING AVERSIONS DUE TO SCHOOL AND CLASSROOM CONDITIONS

This group has been placed first because the general school and classroom-conditions are a constant background for all the positive educational activities. Further, many teachers, both beginners and others, get so immersed in the details of their subject-matter that they neglect these conditions.

It is no exaggeration to say that most children have associated schools first and foremost with aversions, and this is equivalent to saying that they have been in explicit or sub-conscious conflict with school-conditions. The ideal school would be a place to which pupils enjoy going. This ideal has actually been achieved by some schools, particularly nursery and infant schools. However, even if this ideal cannot be reached, it is possible to make every school which is fit for human habitation a place to which children are not unwilling to go.

The most frequent aversions can be classified into three groups according as they are connected primarily with (1) buildings and equipment; (2) the teacher; (3) school-regulations.

BUILDINGS AND EQUIPMENT

Here we are concerned with conditions of over- and under-stimulation and physical constraint. The chief difficulties arise from poor ventilation, bad lighting, incorrect room-temperatures, unsatisfactory seating-accommodation, and lack of sufficient space for some degree of free movement (change of posture and of occupation).

We should cultivate a habit of attending to the pupils' physical comfort before commencing each lesson, and during the lessons. The aim should be to arrange the conditions of normal stimulation which induce in the pupils a feeling of physical satisfaction, general well-being, and security. All their mental activity can then be

concentrated upon their work without the competition of primary hungers which are soon set up by bad conditions.

Some difficulties, of course, will be beyond the teacher's control. Lighting, heating, ventilation, classroom-space, playgrounds, and equipment depend largely upon the provision which the Local Education Authority is able or willing to make. Nevertheless an intelligent teacher, careful for the welfare of the pupils, can often mitigate the effects of bad conditions by making the best use of the facilities available. It is wise to enlist the co-operation of the pupils themselves in arranging expedients. This helps to promote social consciousness and public spirit, and the very fact that the teacher is interested in their welfare will often remove the bitterness felt by children on account of the bad conditions, even if it is impossible to remove them.

THE TEACHER

Personal characteristics and manner

In every social situation outside schools charm of manner is a highly credited characteristic considered to be well worth taking some pains to cultivate, while in school it is frequently conspicuous by its absence. Yet children of all ages are particularly susceptible to the influence of a pleasant, kindly, dignified, humorous, and tolerant personality and respond eagerly even though they may not find his subject-matter particularly fascinating. Many children, in well-to-do homes as well as in slums, are treated with indifference or even regarded as nuisances. Such children are often pathetically eager for friendship, sympathy, and encouragement.

Conditions have improved very much since 1900, but one still detects a tendency to make schools feel like prisons and penitentiaries, with the teachers acting as warders or officers of correction. Now the pupils are required by law to attend school, and they are not in a position openly to criticize the teacher's manner and his method of conducting class-work. They feel this disability and it makes their real or fancied injustices the harder to bear without resentment. Hence we should seek at the outset to establish a happy personal contact with the pupils, such as will exercise a civilizing and liberalizing influence upon their lives.

It is not denied that most children, if they are robust and healthy, are mischievous, and a few are vicious, perverted by bad hereditary endowment or unwise treatment. It is necessary to be firm and establish a reasonable class-order. The fact is, however,

that firmness and order are welcomed by children when connected with a teacher whom they trust and respect. Moreover, reproof from such a teacher has much more influence on their conduct than punishment from one whom they dislike.

Some points to note in this connexion are: cultivate a pleasant voice with clear diction, and avoid monotony in delivery; avoid unnecessary mannerisms and noisy movements; *look at, and speak to the class as though personally interested in each pupil*; avoid sarcasm, superior aloofness, and disdain. In particular do not punish for faults made in ignorance. Generally speaking, treat pupils with the consideration and courtesy due to them as persons. This encourages the development of their self-respect.

Methods of Presentation

All really good teachers are 'artists,' and their lessons have a distinct entertainment value. Teaching should be serious in its purpose, but that is not identical with dulless in presentation. It is a great gain if pupils are attracted by the lessons, even if they do not like the subject.

In particular we should avoid long oral expositions and academic lectures, and provide a reasonable variety of occupation. This keeps pupils busy and reduces boredom.

SCHOOL-REGULATIONS

Regulations are inevitable. The school-authorities must organize a stable routine in which pupils can 'settle down' comfortably and know what is expected of them. Again, the great majority of children prefer an ordered habitual routine which at the same time allows them a reasonable freedom of choice and inclination.

Regulations should be made the means to an end, the end being social economy and efficiency. If the purpose of the regulations is simply and clearly indicated even young children can understand their necessity and value, and will accept them willingly.

The practical problem is to steer a middle way between under-organization which inevitably leads to slackness, chaos, and frustration, and meticulous over-organization in which every detail of every minute is prescribed and carried out by numbers. This latter condition breeds very strong aversions and leads inevitably to evasion or open rebellion.

The regulations should be as few as possible and clearly worded. They must be administered impartially and *must be honoured by the staff* as well as obeyed by the children. A dual code of rules providing exceptions for the staff is a potent source of aversion, particularly in post-primary schools.

Before leaving this topic we must note certain conditions which influence the interest of pupils in school-work, but which are beyond the immediate control of the teachers. Bad housing and overcrowding, malnutrition and unwise feeding, insufficient clothing, minor ailments neglected, and chronic disease—all these factors disturb the pupils' equilibria and set up conflicts which interfere with interest in school. Such factors are due to poverty, prejudice, and ignorance. With respect to these, teachers can assist in the education of public opinion in the direction of good mental and physical hygiene. One approach to public opinion on these matters is by way of the children themselves. Through the teaching of physical exercises and domestic science sound knowledge of the conditions of healthy feeding and living can be given. Adolescent pupils discuss these topics at home, and since they will be the citizens and parents in the next generation good attitudes permanently inculcated in school will bear fruit in an improved public opinion later. For the rest, teachers can co-operate with the school medical authorities, assist in the organization of school-meals, and make every possible use of local voluntary efforts for alleviating the worst consequences of extreme poverty. In spite of vociferous objections from vested interests, school authorities have been forced by the facts into recognizing that the provision of schools and trained teachers is so much waste of public money unless the pupils are in a fit state to profit by the education organized for them.

Selection of Subject-matter

In the actual selection of subject-matter for instruction, practising teachers may have little power of choice. In the first place, any given subject-matter is introduced into school-curricula because it is judged by the community to be socially or economically necessary. Secondly, the work of teachers in junior and post-primary schools is hedged about by the requirements of entrance-scholarship and school-leaving examinations. In any case a full discussion of the principles of selection would take us too far afield for our present purpose.

It can be taken for granted that, whatever the particular variations may be in any given case, the school-curriculum will include the following broad classes of subject-matter: language and literature (including the accessory skills of speaking, reading, writing, and spelling); pure and applied mathematics; pure and applied science; humanistic subjects (geography, history, economics, civics); handicraft and art; physical training and games. This will be true, in a general way, of all types of school from the infant school to the secondary and technical high school.

The problem then, for the practical teacher, is not so much the choice of subjects for the school curriculum as the varying emphasis which ought to be placed upon different aspects of the subject-matter at different stages in school life, and the ways in which the various topics and exercises should be arranged and presented to the pupils, in order to secure the fullest interest and effort on their part.

Referring again to the conditions of interest, we see that subject-matter may be directly interesting because it offers direct satisfactions for certain human hungers; and it may also be indirectly interesting because it is the means whereby other hungers may be satisfied and aversions removed. Hence we may regard subject-matter in two ways:

(*a*) As an *end* in itself. In this case it will appear as actual experience and activity which the pupil lives through *and enjoys*—intellectual food, physical and mental exercises needed by the growing powers of the child.

(*b*) As a *means* to various ends. Here the subject-matter will appear as organized knowledge and skill which must be acquired for efficiency in theoretical and practical pursuits.

From the point of view of interest and educational value, schools have erred in placing undue emphasis, at too early a stage, on the indirect value of subject-matter (*i.e.*, the technical knowledge and skill required for adult academic and vocational purposes) while the direct value as experience and activity to be enjoyed has been in many cases almost, if not entirely, neglected. We can get a better perspective if we consider certain hungers connected with school-work. These are:

Hungers for physical and mental free movement.
Hungers for rhythm, routine, and system.
Hunger for self-enhancement.

To these may be added hunger for group-activity and, in the post-adolescent phase, hunger for substitute sex-satisfaction.

We have noted that, as human physical and mental powers approach maturity, the individual concerned feels a craving for the appropriate exercise. Hence we may expect in the earlier phases of development a craving for experience through all the sense-organs and for free activity of the larger muscle-co-ordinations. Throughout school-life we shall find curiosity, with its accompanying tendency for physical manipulation and exploration, and fantasy (that is imaginative adventure); and the hungers for self-enhancement.

Thus in the infant and junior schools when conducted with a view to interest and good human development, the subject-matter *must be presented as experience and activity.* The children will dramatize various situations—keeping house; keeping a shop or a post-office; running a 'farm' of pets or a flower and vegetable garden; going on a journey; living in an Eskimo igloo, or an African kraal. Their craving for physical activity is satisfied by the action involved, by the help they can give in improvising dresses and scenery, and making simple models required for the dramatic play. They will listen to and later read stories and thus dramatize in imagination. They will manipulate, draw, paint, play musical games, and dance.[1] During this earlier phase knowledge and skill are incidentally acquired in the course of the experience and activity.

Beside the direct value of this experience and activity in terms of enjoyment, the child will find the satisfaction of self-enhancement. Successful use of the natural powers brings a feeling of mastery and confidence. The child frequently says, with elation, "I can do this." He also finds that success brings approbation. He says, "See what I can do," and strives to master various activities in order to gain praise. Further, he wants to do something better than other pupils, and finds the opportunity for rivalry in the school-work.

After the transition to the post-primary stage of schooling, certain kinds of subject-matter will still have direct value as experience and activity. Music, pictorial and dramatic art, constructive practical work, literature of the more romantic kind, dancing, games, are all directly interesting. Further, the hunger for system will lead to classification of knowledge gained incidentally in the earlier stages and to logical order. The more intelligent

[1] See the report of the Exeter experiment p. 44. Also *Intellectual Growth of Young Children.*

pupils will begin to enjoy the æsthetic aspects of order—the simplicity and elegance of a mathematical proof, a scientific hypothesis,[1] a sonnet, or a classical piece of prose. These latter, intellectually satisfying aspects of knowledge and skill should be given due prominence in post-primary work, particularly in dealing with the more intelligent pupils.

In this later period of schooling, however, academic and vocational needs make necessary the introduction of a much larger proportion of theoretical conventional knowledge and skill which has only an indirect interest-value for the majority of the pupils. At the same time, the pupils themselves are in a better condition to appreciate the indirect value. In the first place, the necessity for economic self-support and a career becomes insistent. The young child's hungers for food, shelter, protection, and general well-being were satisfied (in the majority of cases) by parents or guardians. The adolescent begins to realize that he himself will have to provide for the satisfaction of these primary needs. In addition, developing sex-consciousness and its relation with marriage emphasizes the economic value of a good career. In the second place, the growth of the power of comprehension enables the pupil to envisage more distant objectives and to grasp more easily the connexions between what must be learned now in order to secure some benefit in the future.

From the point of view of interest and spontaneous effort, the teacher's main problem in the post-primary period is how to encourage the fullest possible interest in these indirectly valuable aspects of the work. Assuming that aversions due to factors specified on p. 78 above have been removed, the solution of the problem can be achieved by skilful presentation of subject-matter and good grading of exercises for practice.

Procedures in Presentation of Indirectly Interesting Subject-matter, and Grading of Practice Exercises

We may recapitulate briefly to make quite clear the exact problem to be discussed. We find that in the post-primary stage (and to some extent in the junior stage) subject-matter must be introduced which is not directly interesting to the majority of

[1] Compare, for example, the Copernican with the Ptolemaic descriptions of the Solar System.

the pupils because it does not offer them any direct satisfaction. Much of this indirectly interesting material is conventional, and theoretical. It may be required for examination purposes, or for specific vocational tasks, in the future. Examples are grammar, the numerical aspects of mathematics, theoretical science, constitutional history, economic geography. These subjects may, of course, be entrancingly interesting to a few adult academic scholars, but they are not directly interesting to the normal school-pupil. At the same time some parts of such subject-matter must be mastered, and our problem is to present it in such a way as to encourage the greatest possible interest on the part of the pupils.

To do this we can take advantage of the fact that interest spreads by association; and we can organize the work in such a way that it provides some degree of satisfaction for the hungers for free movement, exploration, system and explanation, and self-enhancement. The practical procedures can be classified according as they serve to fulfil one or other of these aims. We will consider them in the order named.

MAKE THE WORK PURPOSEFUL

Here we attempt to use the fact that interest spreads by association. We can show how grammar is necessary for communication, and for the expression of clear meaning. We can emphasize the social value of good grammar and indicate its economic value as an aid to passing examinations, and securing posts. In many professional pursuits the ability to speak and write readily, clearly, and grammatically is essential. In the same way we can associate theoretical mathematics and science [1] with practical craftwork, domestic science, field-work, and practical laboratory work.

Occasionally it is quite effective to give pupils a problem they cannot do because they lack a specific item of knowledge or skill, then when they realize the need, introduce the item concerned and show how it helps in the solution.

The value of this procedure is enhanced if we note what subjects and activities have a strong appeal to individual pupils and then, whenever an opportunity presents itself, associate the indifferent subject-matter with these special direct interests.

[1] See, for example, Hogben, *Mathematics for the Million*; Hadley, *Everyday Physics*.

Making the school-work purposeful is the keynote of the Topical Method of teaching science, and of the Project Plan of organizing school-work.[1]

UTILIZE THE HUNGER FOR FREE MOVEMENT

Interest can be enhanced if the subject-matter is presented in such a way that it provides *sufficient opportunity for pupil-activity.* Teachers must at all costs avoid doing all the work in the classroom while the pupils remain passive listeners and watchers. Pupil-activity is automatic in well-conducted science and craftwork. But it is equally necessary in teaching mathematics, languages, geography, and history. Pupils can answer questions, prepare short reports, make drawings, learn to make their own notes, demonstrate on the blackboard. It is often possible to turn a lesson into a class-discussion instead of an exposition by the teacher alone. In preparing lessons, students-in-training should use every possible opportunity to *organize the active co-operation of the pupils.* Perhaps the worst fault of the average student is his tendency to model lessons upon the lines of a college lecture.

In language-teaching it is most desirable, in the junior forms at least, to organize a *variety of occupation* within one lesson-period. In a forty-minute period a single topic or text-book exercise will admit the use of phonetic drill, oral reading and translation, question and answer, written translation, or dictation. Less ground may be covered, but from a learning point of view this is an advantage, since interest is enhanced, boredom reduced, and memorizing made more efficient.

APPEAL TO CURIOSITY AND THE DESIRE FOR EXPLORATION

This can be done in the following ways:

Organize an anticipatory interest relevant to the topic or exercise before it is introduced. Some teachers find it profitable to put up a list of the topics which will be dealt with during the next month. The attention of the class may be called to current events which are relevant to the topic to be introduced (*e.g.*, an accident to a submarine warship may enhance the interest in the topic of buoyancy in physics).

[1] See Brown, *Teaching Science in School*; Van Buskirk and Smith, *The Science of Everyday Life*; Collings, *Experiments with a Project Curriculum*; Rugg and Schumaker, *The Child-centred School.*

Arrange a striking introduction

This may take the form of an anecdote or amusing joke, or an arresting sensory stimulation.

In using this device, however, we must take care that the striking introduction leads directly into the topic to be considered. A spurious interest which does not develop merely sets up a conflict of interest which may destroy the value of the lesson. Thus introducing a lesson on reindeer by dressing up as Santa Claus would defeat its purpose since instead of the presents associated with Santa Claus the teacher could only deliver information about reindeer. On the other hand, a loud explosion would be a most apt introduction to certain topics in the chemistry of combustion, since it leads directly towards the theoretical work involved.

Bring clearly before the pupils any striking contradictions, inconsistencies, or peculiarities in the subject-matter or in related experience which lead to the questions "Why?" or "How?" Then follow this up by showing how the subject-matter to be studied helps to resolve these queries.

This device is the characteristic of the Socratic dialogue which can be studied in the dialogues of Plato. An excellent example of the device applied to everyday teaching is described in Adams' *Primer on Teaching.*[1]

Make free use of problems and puzzles

This is particularly applicable in teaching mathematics and science. There, instead of presenting topics as material to be memorized, they can be presented as problems to be investigated. The work then becomes an adventure.

Thus we could tell a class that the circumference of a circle is $3\frac{1}{7}$ times longer than its diameter and then let them repeat the fact till it is learned by heart. It is much more interesting to say, "How many times is the circumference of a circle longer than its diameter?" and let the class suggest ways of finding out. Teaching through problem-solving puts a premium on imaginative ingenuity and is most attractive to many able pupils.

Problems are useful for recapitulation as well as for introductions. After studying the chemical and physical properties of water, the pupils can be presented with three or four samples of colourless fluids and be required to apply tests to discover which

[1] See pp. 93 to 99.

of them is pure water. Recapitulation then becomes a little game in detection.

Make the subject-matter develop

At the post-primary stage it is desirable to begin the systematic treatment of subject-matter, particularly where it has a logical structure (as in mathematics, science, physical and regional geography), or when it reveals some type of evolution (as in the history of human institutions).

In these cases the problems or topics which constitute the subject-matter are connected by logical relations, or relations of cause and effect. Then one topic arises inevitably out of the previous topic and leads forward to its successor in the series. Thus, by carefully articulating the syllabus and bringing out the connexions as vividly as possible, the material can be made into a medium for *continuous exploration* and each topic becomes an introduction for the next. By emphasizing the fact of connexion the abler pupils can be encouraged to adopt the attitude of expecting connexions and development, and of actively searching for these.

When dealing with a syllabus which allows of this continuous development, it is advantageous to divide the material into topics and sub-topics, each of which is a comprehensible unity, at the end of which reference may be made to the next following topic, giving rise to anticipatory curiosity. Teachers can often take a leaf out of the book of the publishers of serial stories and makers of screen-serials and close each episode at an intriguing and exciting juncture, whetting the appetite of the pupils for the next topic.

UTILIZE THE HUNGER FOR ROUTINE, SYSTEM, AND EXPLANATION

This hunger is extremely powerful throughout life, and is expressed in the ready formation of any habits, both physical and mental, which will reduce the uncertainty of existence and thus minimize the need for continual alertness. The hunger is an example of the tendency of the human organism to obey the principle of least action.

One finds many examples of disorderly material in school-work, *e.g.*, lists of exceptions to conjugations, declensions, and rules of syntax in Latin. Somehow or other these apparently illogical and arbitrary items must be committed to memory, and in the absence of connexions the task seems insuperable. Much aversion is

prevented and satisfaction enhanced if the items can be arranged in an easily memorizable order. An excellent example of this device is the series of rhyming jingles to be found in certain Latin grammar text-books. (These were almost the only part of Latin the present writer ever found tolerable.) The satisfaction in these mnemonic routines is considerably enhanced by rhythm.

The beauty and relative simplicity of system is well revealed in theoretical science. Note the attractiveness of the Periodic Classification of the elements in chemistry, and of the reduction of many branches of physics to the concept of wave motion.

Hence, at the more advanced levels of study particularly, the systematic nature of certain kinds of subject-matter should be emphasized, and the main principles of the system made as clear as possible. The present book is actually an attempt to reduce the multifarious details of everyday school-practice to a comprehensive system.

The value of an intellectual system is enhanced when it affords an explanation of puzzling facts in everyday experience. Explanation consists in referring some particular fact to a logical system, thus enabling us to understand it. The delight afforded by modern theories of evolution in biology arises mainly from the fact that they resolve so many otherwise incomprehensible contradictions presented by the study of the varieties of living things.

This interest in system is so strong that it may become an intellectual danger. We are prone to accept the first system we can invent, and we are so satisfied by it that we cease to question its probable correctness, and resist any attempt to revise it.

UTILIZE THE HUNGER FOR SELF-ENHANCEMENT

This hunger is satisfied by domination and a position of superiority. These results bring elation and increased self-valuation. Conversely, being beaten, or suffering a position of inferiority causes intense aversions and loss of self-valuation. School subject-matter may be the means to a position of domination and superiority. A problem solved is a problem dominated and beaten. Competition for class-positions is one way of obtaining superiority. The very fact that a topic is clearly understood, and can be applied successfully in further studies produces a feeling of mastery, confidence, and elation quite apart from any intrinsic interest in the subject-matter itself. Even more important is the fact that what is apprehended obscurely and not understood produces intensely

unpleasant feelings of helplessness, anxiety, and frustration, particularly when the pupil is required to apply his knowledge in answering questions or solving problems. His failure then becomes public and may lead to penalties. Thus any interest is destroyed and effort damped down. To proceed with the work is equivalent to inviting further humiliation.

Hence we must attempt to *organize success and minimize the liability to failure* in school-work of all kinds. What practical procedures are available for this purpose ? We have :

Selection

In selecting topics for instruction and materials, tools, and exercises for practical work, we must adjust the difficulty involved to the degree of maturity, and the aptitudes of the pupils.

Too difficult work, which is beyond the pupils' native intelligence, or which has been introduced before they are ripe for it, will inevitably cause failure and the resulting aversions. On the other hand, too easy work, which can be accomplished with nonchalance, will be despised as childish and will bring no increase in self-valuation. This need for adjusting the difficulty of the work emphasizes the importance of the study of general and intellectual development. The course of general development has been touched upon in Chapter II. A detailed discussion of intellectual development will be given in Section III later.

It follows from this rule that if the school-organization is to be really successful, there must be either some degree of individual treatment for different pupils,[1] or careful grading and the arrangement of homogeneous classes or groups with appropriate modifications of the syllabus to suit each group.[2]

If a heterogeneous group of pupils, particularly at the post-primary stage, is taught as a class, then the amount of material introduced and the rate of progress will be too great for some pupils and too small for others. The result will be either frustration or boredom.

Presentation

(*a*) In presenting the subject-matter we must take every precaution to make it clearly apprehended and thoroughly under-

[1] As in the Dalton Plan.

[2] Note the 'triple-stream' and 'double-stream' systems of grading; the so-called 'vertical' classification; and the public-school system of teaching 'sets.'

stood. For this purpose we must be guided by the course of intellectual development. This will be appreciated more clearly after reading Section III. For the moment we will anticipate that section by stating a few obvious rules:

Begin the treatment of a new topic by using concrete examples already made familiar by experience, and proceed through these to abstract principles and formal definitions. Principles and definitions are the end-points of instruction—not the beginning.

Relate new knowledge clearly to knowledge already mastered.

Illustrate the unknown and obscure, in terms of what is familiar and clear.

(*b*) Avoid presenting more material at any one time than can be assimilated comfortably by the pupils. Overloading lessons is a frequent error.

(*c*) Introduce only one new difficulty at a time, particularly in mathematics. (But the rule applies also to other subjects.)

(*d*) Present the successive steps in the lessons in logical order, that is to say, present what is required to make the next step clear before proceeding to it. In all subjects with a logical structure (*e.g.*, grammar, mathematics, and science) the order of presentation is an essential factor in clearness.

In the past this rule was frequently broken in teaching fractions. The rules for addition, subtraction, multiplication, and division of fractions were taught before the notion of the equivalence of fractions had been thoroughly mastered.[1] Until this key-principle of fractions is understood the rules for computation must remain so many arbitrary mysteries.

Even in story-telling the point of the story depends upon the orderly development of the plot. Nothing is more tiresome than having to listen to a recital during which the narrator keeps saying, "Oh! I forgot to say that. . . ."

(*e*) Treat one topic sufficiently thoroughly to make it clear before proceeding to the next. Perhaps the most effective way of confusing children whose powers of comprehension are not fully mature is to get half-way through a topic, then introduce another topic, and before that is satisfactorily completed return to finish off the first. Actually this practice is by no means infrequent and the unfortunate pupils detest it.

(*f*) Avoid harrying and driving the pupils. Mental assimilation

[1] *I.e.*, $\frac{2}{3}=\frac{4}{6}=\frac{10}{15}$; $\frac{1}{2}=\frac{2}{4}=\frac{4}{8}$, etc.

does not occur instantaneously any more than does physical digestion. It needs time. Hence allow sufficient time for reflection during which the mental organization is accomplished.

(*g*) Introduce sufficiently frequent and regular recapitulation, and revision, to keep the salient points in the course of study already covered, fresh in the pupils' minds. This ensures that the new knowledge is continuously associated with the old.

Grading of Exercises for Practice

Practice is an essential factor in the mastery of many kinds of school-work, and it is usual to provide opportunity for it by arranging special exercises.

Success can be emphasized by careful grading. Thus we should commence with the easiest possible exercises which illustrate the point at issue. Much work in mathematics and grammar is made unnecessarily forbidding to the pupils because the early exercises are too abstract and difficult.

The pupil should continue with the exercises until the feeling of mastery is felt.

In correcting exercises we should emphasize success by marking somewhat more leniently and criticizing less severely in the early stages of practice. The standards can be raised progressively as proficiency and confidence develop. To mark and criticize savagely at the beginning is like pinching out the top of a tender young plant.

This last rule was well exemplified in a learning-experiment undertaken by a number of American university students. One section of the students believed that they had reached the limit of their ability to improve, and, more or less unwittingly, ceased to try further. The supervisor thereupon 'arranged' the scores of that section to show an apparent increase. At once the students concerned renewed their efforts and went on to catch up and actually beat the artificial improvement.[1]

RELATION BETWEEN HABIT AND MASTERY

Habits facilitate the ease, speed, and accuracy of recall and performance. They are therefore an essential factor in mastery. In many cases new work is interfered with seriously and progress prevented if certain preliminary ideas and processes have not been made habitual. It is doubtful whether a pupil can ever arrive at

[1] Book, *Economy and Technique of Learning*, Chapter VIII, Section III.

the ability to read the literature of a foreign language with enjoyment and full profit unless he can recall meanings of words, interpret idioms, and follow the grammatical constructions automatically. The same principle is obvious in skilled crafts.

There has been a tendency to react from the earlier insistence upon verbal repetition in learning by going to the opposite extreme and decrying all habit-formation. Such an extreme reaction is psychologically unsound. It leads to sloppiness, vagueness, inaccuracy, and waste of time, and since these shortcomings prevent adequate mastery in the pupils concerned, interest in the subject-matter remains superficial and is always liable to be cancelled out by the irritation of failure. Habits may be bad masters but they are extremely good servants.

RELATION BETWEEN APTITUDE, ABILITY, AND INTEREST

The efficient utilization of the hunger for self-enhancement in promoting interest in school-work introduces a topic not sufficiently well recognized in educational psychology and school-organization, namely, the relation between aptitude, ability, and interest.

By ability we mean here actual facility in some given performance, *e.g.*, writing shorthand at the rate of 80 words per minute; running 100 yards in 10 seconds; solving problems of a given degree of difficulty in mathematics. Each ability presupposes, beside practice, certain corresponding aptitudes. Without aptitude practice is ineffective, and without practice aptitude remains latent.

Now, it is obvious that interest will tend to generate ability, since the interested person will practise more frequently and with greater zest in proportion to the interest.

At the same time it is true that aptitude tends to generate interest. The person with good aptitude succeeds more quickly on taking up a new task which involves the aptitude in question. His practice produces more rapid results which in turn produce elation and confidence, and this pleasure arising from success leads to further practice, more skill, renewed pleasure and continued interest. Other things being equal we tend to continue our successful performances. The success makes them interesting.

This relation between aptitude and motivation suggests certain points of importance for school-practice.

It should be a function of the school to *discover aptitudes* as well as train them. For this reason, premature specialization in either academic or industrial pursuits is most undesirable. It

tends to stereotype an individual before his aptitudes are given a favourable opportunity for expression.

Once a pupil's predominant aptitudes are discovered, the school-work should be organized as far as possible in relation to them. In this way interest will spread by association.

There should be, in a good school, a sufficient variety of activities to allow every pupil some degree of success. Psychological tests have shown that different pupils, even those with good intellectual capacity, vary widely in their individual aptitude endowment. Hence it is unlikely that they will all obtain adequate opportunity for success and therefore attain full interest in school-work if the curriculum is restricted to one type of subject-matter only, *e.g.*, the linguistic-mathematical type in which the traditional secondary school has specialized almost exclusively.

The desirability of organizing opportunities for *successful* work by every pupil is the psychological and educational justification for a multi-lateral post-primary school-system, or for schools with alternative courses.[1]

MOTIVATION OF MONOTONOUS REPETITIVE WORK: ORGANIZING INCENTIVES

When a very high degree of skill is required for professional pursuits long and arduous practice is essential. At the beginning of the work progress is usually rapid, and the success keeps up sufficient interest to maintain the effort. However, the initial success is often followed by a temporary period of no improvement (a 'plateau-' period) although the practice is maintained. The learner may pass through several of these periods before approaching the physiological limit of skill and speed at which practice produces no further improvement.

The difficulty in monotonous repetitive practice is to maintain sufficient interest in the task to overcome the strong aversions set up by the monotony, particularly during periods of no improvement. This concerns closely the teachers of technical subjects, but it may arise also in other subject-matter in normal school-work. What can be done to encourage and maintain interest in this case?

The aim must be to organize a number of positive incentives in connexion with the work so that the compounded effects of several partial motives will eventually become strong enough to overcome the aversion caused by the monotony.

[1] See Board of Education, *Report on Secondary Education.*

An incentive is any objective for which a person is willing to strive. Again we shall find it possible to utilize the hunger for self-enhancement, and most of the procedures indicated below owe their value to the operation of that hunger.

We will assume again that the classroom-conditions are good, that there is a satisfactory co-operation between pupils and teacher, that the nature of the task to be accomplished has been set forth clearly by the teacher and understood by the pupils.

We can utilize the following procedures :

Arrange rewards (and if necessary, penalties)

In vocational training it is possible at times to arrange for material rewards (*e.g.*, money-payments, increases in pay, bonuses for improvement). In school-work these are seldom practicable. There the rewards must be prizes, marks, privileges, positions of responsibility ; and the penalties, the withholding or loss of these.

Praise and blame constitute effective incentives if given by a respected teacher in a judicious and not too lavish manner. Also praise or blame in public adds to the incentive.

The effects of praise and blame were investigated experimentally by an American teacher. Four groups of children equivalent in age, sex, and ability were required to work standardized tests in arithmetical addition for fifteen-minute periods on each of five days. The first group did the work in a separate room under normal conditions, and no comments were made on their work. Groups two, three, and four worked in one large room. The members of group two were called by name before beginning to work and praised publicly for what they had done in the previous test. Members of group three were publicly reproved. Group four was ignored.

The results showed that, taken by groups, the order of improvement was (i) highly praised, (ii) reproved, (iii) ignored, (iv) control group (first group mentioned above). When the results shown by individual pupils were considered it was found that *reproof* was more effective with boys than girls, and with children of superior ability.[1] The children of inferior ability were motivated more strongly by praise than reproof.[2]

Objections have been raised against rewards as incentives. There is a danger that the reward and not the work will become the primary object of interest. Now, in normal conditions, where the work is valuable and interesting in itself, such a result is

[1] Probably they were complacent with respect to praise.

[2] Hurlock, *Journal of Educational Psychology*, Vol. 16, 1925, p. 145.

harmful. But in the particular case we are considering the work is by its nature intrinsically uninteresting and when progress is slow or has stopped, the work cannot possibly be its own reward. A more powerful objection concerns the conditions of award. If the rewards are given for actual success, then the pupils with the best native endowment will always get them and the others will cease to try. Rewards should be given for steady work and conscientious effort as well as for success. Then every pupil has a chance of winning.

Introduce an element of rivalry and competition

Again there have been serious objections to competition, and some people have tried to eliminate it altogether from school-work. This undiscriminating attitude seems both unwise and unnecessary. If the work is so organized that the rivalry is the *only* incentive then the system may be harmful, particularly as it tends to arouse animosity and encourage the taking of unfair advantages. This objection, however, is against the abuse rather than use of competition. Also, however much one may deplore the fact, there are people, adults as well as children, who will not do any tedious work unless they are competing against others.

The rivalry need not be for individual advantage only. Competitions can be arranged between teams, classes, and ' houses.'

Utilize biographical material

There are numerous examples of people—skilled at sport or artistry of some kind—whose success is due in part at least, to monumental patience and assiduity in practice. The fact that some well-known person has had to practise and has overcome difficulties thereby may be very stimulating to some pupils, particularly when they are on the point of giving up in disgust or despair. The school-library should contain some accounts of distinguished people who have owed some of their success to assiduous work.

Arrange definite objectives which the learners believe to be within their capacity to achieve

This procedure is most valuable in providing incentives. It can be accomplished in the following ways:

(i) Prescribe *in advance* a definite limit for the period of practice and do not allow it to be exceeded.

Compare the effect of the two following instructions :

> This work is not particularly interesting, but it must be done. Work as hard as you can at it until I tell you to stop.
>
> This work is not particularly interesting but it must be done. Work as hard as you can at it for fifteen (twenty, etc.) minutes, and then you will be able to rest.

In the second instruction the definite limit restricts the work within a period which is recognized by the worker as being not really long, and the rest at the end of the period is a definite reward worth striving for. The first instruction indicates no such definite objective.

The time-limit must be fixed according to the difficulty of the work and the capacity for endurance of the learners. In any case the work should be stopped while the learners are still fresh. It is necessary to prevent the discomforts of fatigue from reinforcing the other aversions to the monotonous work.

(ii) Prescribe *in advance* a finite task within the pupil's capacity to achieve. Indicate exactly what is to be done.

In the case of a bad speller, choose say five words only which he frequently misspells and limit the task to the learning of just those five words. This is much more effective than requiring him to learn all the mistakes he made in his last piece of dictation. The very wording of this instruction makes the task seem indefinite and relatively enormous. Even if 'all the mistakes' amount only to five, it feels easier to learn five than all of them. This rule is also valuable in vocabulary and grammar work in a foreign language.

It has been well said that in teaching we should be not only definite, but finite.

(iii) Secure a definite undertaking to finish the work within the time prescribed.

It is useful with a wavering pupil to encourage him to make a definite declaration, in public if possible, that he will accept responsibility for some definite piece of work, or that he will finish the work in a definite time. Most pupils have a crude sentiment of honour manifested in a desire to 'keep to one's word.' Among themselves they dislike those who will not keep a declared promise. Therefore persuade the unwilling waverer to give a definite affirmative promise. Do not accept evasions and half-promises such as, "I'll think about it," or "I'll let you know to-morrow,"

etc. Make your active help and encouragement conditional upon a definite declaration.

This principle has been used in the 'contract' system incorporated within the Dalton individual work plan. Pupils undertake to complete all their assignments within a month, or whatever is the specified time, and not to proceed to the next month's assignments until all the current work is satisfactorily completed. In this case, the desire to get on to the next assignments in the more interesting parts of the work is an added motive for completing the less interesting present tasks.

(iv) Set a definite standard of work to be aimed at.

If the learner has before him, clearly, a standard of achievement, he can compare his own merits with the standard. If he falls short, his desire for self-enhancement is still unsatisfied. If he reaches or surpasses the standard he enjoys the pleasure of success.

The standard may be one of quality or quantity (*i.e.*, speed).

It follows from our principles of motivation that the standard prescribed must advance *proportionately with the learner's aptitude and improvement* if this incentive is to maintain its full efficiency. We have seen that if the learner cannot achieve the standard, he feels frustrated and begins to doubt his capacity. That feeling quickly damps out effort. Therefore he must be allowed to reach the prescribed standard quickly enough to prevent the feeling of frustration and futility. On the other hand, when the standard has been surpassed, satisfaction supervenes and that means that no further effort is needed. The learner leans back and takes his ease. Hence, for continuous practice a *moving* standard is necessary.

The value of a moving standard has been investigated by C. A. Mace.[1] (Incidentally, Mace's experiments afford a convincing demonstration of the correctness of some of the principles of motivation set out in this and the two previous chapters.)

Mace tried to discover an incentive which would increase in value as the practices proceeded, thus cancelling out the accumulating effects of familiarity and boredom.

The first experiments involved university students. They worked complicated routine arithmetical computations for ten-minute periods, four days per week, during six weeks. Group A were told to *beat their own previous records, i.e.,* the average number of correct computations

[1] *Incentives, Some Experimental Studies*, Industrial Health Research Board Report No. 72, H.M. Stationery Office, 1935.

completed by them in a ten-minute period during the previous week. Group B were told to *attain and if possible surpass a definite absolute standard*, namely, 70 correct computations in a ten-minute period.

Groups A and B were equal in initial ability but the results showed a small superiority in favour of group B. It was noted, however, that the workers in group B showed a rapid improvement *just when the standard*—70 correct computations in a ten-minute period—*was nearly attained*. This suggested that the effect of the prescribed standard as an incentive would be continuously maintained at a maximum intensity if the standard were arranged so that it was always just within the learner's reach.

This suggestion was tested in a second series of experiments. Two groups of boys, aged $11\frac{1}{2}$ years, worked arithmetical computations for twenty-minute periods on five consecutive days, Monday to Friday, during two weeks. Both groups were given pocket-money—3*d*. per week for regular and conscientious work, and special bonuses.

Group A worked first. In addition to the reward-incentive they were instructed to beat their own previous best performance. From the results of this trial, an estimate was made of the number of correct computations which could be expected from a typical good, medium, and poor worker. This estimate was then used to set the moving standard for group B.

The latter worked under the same conditions as A, except that a definite standard adjusted to the initial ability of the worker was prescribed *at the beginning of each work period*. The instructions were to attain or surpass this standard which moved upward along with the worker's improvement.

Group B showed a striking superiority over group A. Moreover, the improvement was *continuous*. Usually, largely owing to the unwitting easing up when one's previous best record has been surpassed, improvement shows a series of reversals in performance. The ability falls off for a time. In Mace's second series of experiments, every worker in group A showed *two or more* reversals, during the first ten-days' practice. In group B, only one worker showed as many as two reversals, seven showed only one, and two, none at all.

(v) Keep the learners informed about the results of their work.

Practice has very little effect on improvement if the learners are kept in ignorance of their results. Hence frequent assessment is needed. In another experiment by Mace [1] a group practised throwing darts for thirteen periods during which they were informed about their scores, and for thirteen periods during which the results were withheld. They continued to improve up to the

[1] Same Report, p. 26.

end of the first thirteen periods and then began to deteriorate. A second group reversed this procedure, being informed of their progress after the thirteenth period. In this group it was found that the immediate effect of giving information about the results was greater than that produced by the thirteen previous practice-periods.

Combining Incentives

The effect of all these incentives can be compounded together. Thus:

Express confidence in the pupil's power to succeed if he tries.
Let him know that you expect him not to let himself, and you, down by failure to try.
Call attention to other pupils who have succeeded without having any greater aptitude than his own.
Praise improvements, and spells of conscientious effort.
Organize the work so that he gets definite tasks within his capacity, and early success.
Prescribe definite and advancing standards.

In addition note the predominate temperamental traits of each pupil and modify your attitude accordingly. The lazy ones may need more supervision and some penalties. Pugnacious, aggressive pupils react favourably to a little judicious and calculated bullying. It brings out their pugnacity. Timid, cautious pupils respond best to kindly encouragement and praise.

Exercises

1. What is your favourite (*a*) subject, (*b*) game, (*c*) leisure-occupation? Analyse the reasons for your preference in each case.

2. Collect instances of aversion to school-work changing to positive interest as ability increases or when some particular cause of lack of understanding has been removed.

3. Collect instances from your own case and that of fellow-students in which aversion to some subject or topic can be traced to a teacher who taught it. What traits in the teacher aroused the aversion?

4. Compare the attitude of pupils to (*a*) a game, (*b*) a story, (*c*) a handwork lesson, (*d*) an exposition lesson. Are all the pupils equally interested? If not, what type of pupil seems most interested

in each case? How far is interest in games and handwork related to ability therein?

5. Compare an interesting book of your acquaintance with a dull book in the same subject. What differences in manner and order of presentation seem to account for the difference in interest-value?

Compare two lectures (or lecturers) from the same points of view.

Apply the results of your study to your own case in teaching.

6. Compare the spontaneous interests of (*a*) a group of bright children, (*b*) a group of dull children, of approximately the same age, sex, and environment. What similarities, differences, do you note?

7. Compare the play-interests, and school-interests of a group of girls and a group of boys of approximately the same age, ability, and environment.

8. Ascertain the subject-preferences of a group of boys, and girls, at different ages.

Which seem to be the most interesting, least interesting subjects at a given age?

What changes occur with advancing age?

Are there any significant sex differences? (*E.g.*, compare attitudes of boys and girls to language-study, history, the sciences, handicraft, mathematics.)

What bearing has your study upon (*a*) differentiation of the curriculum according to sex of pupils, (*b*) organization of curriculum for different ages of pupils?

9. Study the effect of various incentives upon pupils (*a*) of different temperaments, (*b*) of different grades of general ability.

10. Try to obtain by observation, careful questioning and discussion a record of the aversions felt by (*a*) a number of bright pupils, and (*b*) a number of dull pupils, in school.

Analyse these aversions and find out (i) which are related to the school-buildings; (ii) which to the teacher; (iii) which to the school-organization; (iv) which to the school-work.

Compare the aversions of the bright pupils with those of the dull pupils. What differences do you find?

Consider how some of these aversions can be removed. Try to carry out your suggestions practically and find out whether the aversions diminish or disappear.

Think back to your own school-days and compare your own aversions with those you collect from the pupils.

Note.—When asking children questions about their interests, preferences, aversions, do not forget that some children always try to tell you what they believe you would like to know without regard to the strict truth. Hence pupils' assertions need to be corroborated by repeating the questions on other occasions, and by independent observations of their activities when they do not know they are being observed.

Also in asking the questions care must be taken to avoid suggesting possible answers.

Book for Further Reference

SCHOHAUS: *Dark Places of Education.* (Some first-hand accounts of aversions towards school and school-work.)

SECTION III

INTELLECTUAL DEVELOPMENT

THE AIM OF INTELLECTUAL EDUCATION—ERUDITION OR WISDOM

THROUGHOUT educational history one finds educational reformers criticizing schoolmasters for producing men who are merely learned instead of being wise. The difference is very significant in everyday life as opposed to school-work. In general terms we may say that the merely erudite person possesses a great deal of technical information or skill, but cannot use it in circumstances not immediately connected with his learning. He is a reproducer, not an originator or even an adapter. On the other hand, the wise man can successfully apply his knowledge (or skill) in a variety of circumstances not immediately connected with his learning.

Thus, education may be specific or general. General education implies one or both of two meanings :

(*a*) The knowledge and skill gained cover several branches of human activity.

(*b*) Knowledge and skill learned in one branch can be applied with success to other related but not identical activities.[1]

If the second meaning is intended, the person so educated must possess a just appreciation of the value of his knowledge and skill, good judgment of the requirements of a problem, and power of adaptation. The essential difference between wisdom and erudition is the difference between intellectual power and ability to memorize.

The difference is important even in modern industrial and commercial work, in spite of the tendency to reduce all such activity to a standardized routine. When the routine breaks down the most valuable people are those who can size up the new situation quickly and accurately, and act wisely on their own initiative. It is important above all in matters of citizenship and home life where complete standardization of routine is neither possible nor desirable.

On the whole, post-primary schools, particularly of the secondary

[1] *Cf.* Chapter IX.

and technical types, have put most stress on erudition (including specific skills as well as specific knowledge). This has been due to several causes. Examinations have set the standards in these schools, and it is easier to examine erudition than wisdom. Employers of labour like a certain amount of initiative in their employees but not too much. The teachers themselves tend to be erudite. They are the most successful products of the school-system in question.

It is desirable that we should define our aim in teaching, particularly since the post-primary period is the one most favourable for the systematic training of pupils. We need to aim at both the acquirement of knowledge and skill and the training for intellectual power up to the limit of any given pupil's native aptitudes. Both these aims can be realized through the medium of school-activities, provided that the aims are clearly formulated and the value of school subjects in relation to both aims is realized. In any particular case, realization of the aim selected will depend mainly upon the way in which the subject-matter is presented to the pupils. We can teach mathematics as a series of tricks for working commercial and technical calculations. Each particular trick and its common uses can be presented and learned *as a separate unit.* On the other hand, mathematics can be presented as the study of *general principles of number and magnitude.* Viewed in this way many tricks of calculation which would seem at first sight to be quite different processes are now seen to be only variants of a single general principle. Moreover, exercises in mathematics can be used either as instances of methods of calculation or as problems requiring clear thinking and sustained logical reasoning.

If the more general and more desirable aim is to be realized, we must have a clear appreciation of two things—the nature of the aptitudes and thinking-processes involved in intellectual power, and the characteristics of the various branches of subject-matter. Such clear appreciation is essential since it is possible to achieve a result without being able to describe how, or explain why we can do it. A person may reason successfully even without knowing he is reasoning. However, before a teacher can train pupils how to observe, or reason, he must first realize clearly what these processes are, and the conditions in which they can best be carried on.

In the present section of the book we shall endeavour to analyse the more important mental processes involved in the development

of intellectual power. In a later section we shall try to show how the results of that analysis can be applied to the problem of improving practical teaching.

This analysis of the course of intellectual development is directly connected with the principles of motivation and interest discussed in the previous section. We there found that mastery and understanding of the subject-matter are factors in interest, and are more likely to be achieved if the material is presented to the pupils in accord with the course of their development.

CHAPTER VI

EXPERIENCING—BECOMING ACQUAINTED WITH THE ENVIRONMENT

A. Experiencing at First Hand

PERCEPTS AND PERCEPTION

In a familiar situation the adult observer recognizes a large number of objects. Each object is individualized and named. It appears to stand out *as an object* distinct from a vaguer background. Also, objects seem to be ordered and related with respect to the observer, and to one another. The actual experience of any particular object or related group of objects is called a *percept.*

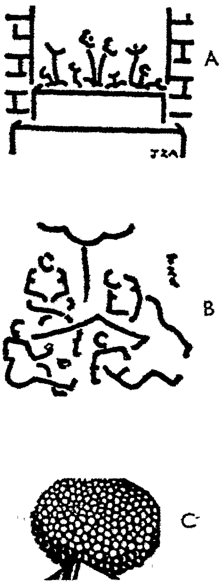

Fig. 2

To an adult the recognition of a familiar object seems to be a simple and instantaneous process. It is possible to show, however, by experiments that perception is a complex activity, and that each percept has its own history in the mental development of the observer.

Look carefully at the drawings *A*, *B*, and *C* in Fig. 2. With respect to each one try to answer the question, "What does this represent?" At the same time try to observe as carefully as possible what mental processes are going on in yourself.

Most readers will find that they are aware, immediately, of a series of black marks on a white background. This bare immediate awareness *via* a sense-organ is the sensory stimulus, or sensation. Over and above this bare sensory awareness we feel puzzled. We say to ourselves, "What is this?" or "What does it mean?"

At the same time we find ourselves *trying to fit a meaning upon this sensory pattern.* We try to think of some object it might possibly represent, and then we test whether the imagined object

fits the sensory pattern. Usually at first we are not satisfied. Something seems wrong. We imagine a second possibility and try that. We may again be unsatisfied and try yet a third time, and so on. This process of trial and error goes on until either we find a solution which seems satisfactory, or we get tired, and bored, and give up the puzzle. As an example, object *C* might possibly be a pincushion on the corner of a shelf, a tree behind the corner of a wall, the shell of a sea-urchin.

Now comes an interesting question. From where do we get these possible meanings? It is clear that they are derived from our past experience of objects which resemble the sensory pattern in the puzzle-picture.

We may ask then, why we do not feel any puzzlement when observing a familiar object. Actually we do so *if the object is seen in an unfamiliar position or unfamiliar surroundings.* For example, Fig. 3 represents an object perfectly familiar to nearly everybody, yet few people can correctly interpret the picture at first glance.

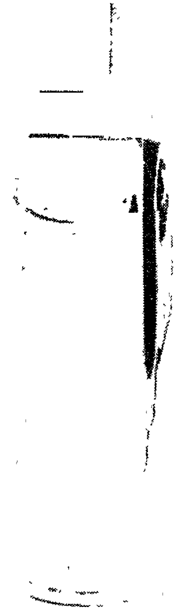

FIG. 3
A common object viewed from an uncommon angle. What is the object represented?

Tests such as these indicate quite clearly that perception involves two related functions:

(*a*) Immediate response to a set of sensory stimuli (which may be received through any one of several sense-organs).

(*b*) *An activity of construction* which seems to change the sensory stimulus into something beyond its immediate sensory character. In other words, the sensory stimulus is *interpreted* in this constructive process by means of ideas derived from our past experience. In familiar circumstances the interpretation appears to be instantaneous. The significance of the sensory pattern seems to be given with the appearance of the pattern itself. Normally, we act upon the interpretation and the act is successful, that is the interpretation fits the environmental situation. It is not until we are faced with unfamiliar circumstances that we falter, and then the distinction between sense-impressions, and the interpretation we put upon them, becomes clearly apparent.

The operation of this constructive interpreting process in perception can be illustrated in many ways. Here are some examples :

Most people are aware that we have a ' blind ' spot in each eye, just at that point on the retina where the optic nerve cable passes inward to the brain. If the left eye be closed, the spot *A* fixated steadily with the right eye,[1] and the book brought from a distance of a foot towards the eyes, a position can be found at which the spot *B* will completely disappear. The area blotted out by this blind spot can be quite considerable in distant vision. For example, I find that by putting the paper flat on the table, and fixating *A* with the right

FIG. 4

eye held vertically above it at a distance of twelve inches, a halfpenny with its centre 3·8 inches to the right of *A* just completely disappears. The blind spot, in that position, therefore blots out an area *one inch in diameter*. Yet in normal vision, *even with one eye*, we are not aware of blank spaces in the visual field. The area covered by the blind spot cannot actually be seen, however. The details it covers are *constructed* by the interpretative activity of the perceptual process.

The perceptual process can be analysed by the use of an instrument called a tachistoscope. This exposes objects or diagrams for a fraction of a second only, thus removing the sensory impressions before the interpretative process is completed. Using this apparatus Bartlett showed a diagram like that in Fig. 5.[2] After the short exposure, observers named what they believed they had seen, and then attempted to draw it.

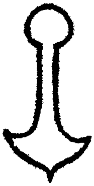

FIG. 5

For our present purpose, the significant result was that the drawings resembled much more *the object named* than the diagram actually seen. It was called a ' pickaxe ' and drawn with pointed prongs ; a ' turf-cutter ' and drawn with a rounded blade ; a ' key,' ' anchor,' ' shovel.' Only one observer correctly reproduced the point in the middle of the blade, and he had called the figure a " prehistoric battle-axe."

This experiment thus reveals another feature important for a later discussion, namely, that the interpretative ' schemas ' or ' stereotypes ' as they are sometimes called (*i.e.*, the pattern of ideas we try to fit over the sensory impression), are habitually associated with a name. Thus the name serves to recall the whole complex arrangement of ideas we habitually associate with it.

The interpretations are not, of course, only visual. They can be

[1] The observer must look *steadily* and continuously at the spot *A*.

[2] See *Remembering*, p. 19.

derived from the experiences of all our sense-organs. Thus a steel object viewed at a distance 'looks' heavy, smooth, cold, hard. These descriptions, 'heavy,' 'smooth,' 'cold,' 'hard,' do not represent actual observations. They are *suppositious* drawn from past esperiences of obiects which look similar to the one now observed. If a piece of cardboard be made to look like a solid cube of copper, then when we lift up the supposed cupper cube the hand seems to fly into the air and we experience a feeling of surprise. The cardboarb cube has been interpreted as a heavy object and we put forward the amount of effort usually necessary to lift such an object.

The process of interpretation in perception is often the cause of serious errors and distortions in observation. The paragraph previous to this contains five spelling mistakes. How many of these were noted by readers? Glaring errors may pass unnoted because the attention of the reader is concentrated upon the meaning of the sentences. This being so, we actually appear to observe, not the spelling of the printed words on the page, but the spellings which would be needed to make the meaning of the passage sensible.

PERCEPTION A CONATIVE PROCESS. STRIVING AFTER MEANING

There has been a tendency to assume that perception is a process in which an impression is made by an external influence upon a *passive* recipient, in much the same way as a pattern is imprinted upon a sensitive photographic film. This view is quite misleading and most unfortunate from a teaching point of view. It is easy to demonstrate that perception has a considerable component of striving in it. When we are presented with a stimulus-pattern which is not immediately intelligible, we experience a restless dis-satisfaction and we try to fit first one then another possible interpretative schema on to the sensory pattern in order to establish a meaning for it. The unpleasant feeling-tone, and the striving to fit a meaning to the pattern persist until we have found one which seems correct—that is, one which satisfies us. This conative process—striving after meaning—in unfamiliar or ambiguous situations is an important factor in curiosity.

PREPERCEPTION AND APPERCEPTION

The systems of ideas derived from past experience, and associated with names, which we bring to bear upon the sensory impressions presented to us by the environment, are called 'pre-percepts.'

Thus, when we attend to an object, or situation, two sets of

influences are mutually active. The present experience modifies existing pre-perceptual schemas. If the object is a variant of some familiar type the corresponding schema is made more comprehensive, being reorganized to assimilate the new experience. At the same time *the already existing schema determines to some extent the way in which we shall perceive the new object.*[1] The incoming sensory impressions seem to be fitted into an existing mould.

Consider again the drawings in Fig. 2. Note the changes which occur in your experience of the patterns when descriptive titles are given. Drawing *A* is called "The Week-end in the Garden." The puzzling pattern of lines now resolves itself into a window-box containing flower plants. The horizontal lines at the sides of the picture take on the appearance of bricks. The flat pattern seems to fill out and become more solid. A pleasant feeling of satisfaction takes the place of doubt, suspense and further striving.

B is entitled, "The Week-end out of Doors." It now becomes unmistakably a representation of a picnic-party.[2] *C* is a cutting from an advertisement of those popular sweetmeats, "Liquorice All Sorts." Readers familiar with this brand will be able now to 'place' the drawing, which, previously might have seemed to represent a tree on the top of a wall, or a colony of soap-bubbles, a pincushion, or possibly a biological specimen! These diagrams serve to illustrate how the pre-perceptual schemas suggested by the titles "The Week-end out of Doors," etc., *mould* the sensory patterns. Note also the feeling of satisfaction when we have finally got our interpretations correct.[3]

This *mutual* influence of immediate experiences and pre-percepts is called 'apperception.' It is, as it were, the growing point of mental life.

DISTORTION AND ERROR IN PERCEPTION

We can now understand more clearly the source of that common difficulty in school-work—errors and distortion in perception due to faulty apperception. Several types may be noted:

(*a*) Gross error in perception of sense-impressions.

Any very strong expectation or belief may produce an illusion of actual experience. This is shown in science-work. If a substance is given to a student to be chemically analysed and some person quietly yet firmly suggests to him that a particular chemical

[1] *Cf.* the failure to note the spelling errors on p. 141.

[2] Showing four people sitting or reclining round a cloth spread under a tree.

[3] Frequently one gets amusing (and instructive) interpretations from young children. One small boy, aged about two years, on seeing the sea for the first time exclaimed, "Look! a big bath."

element is present, it is difficult for the analyst not to see the signs of that element in the course of the analysis. Strong expectations arising from such suggestions will produce illusions of colour, smell, and taste definite enough to appear unmistakable facts. Scientific workers must guard against the possibly distorting influence of anticipation on observation. Research work needs to be repeated by different observers with different expectation patterns and different past experience, so that errors due to personal idiosyncrasy may be cancelled out.

(*b*) Distortion due to *selection* of certain aspects only from a total situation and consequent omission of other aspects which do not fit the particular pre-percepts used in interpretation. A person not interested in geology, and having no knowledge about it, will fail to note the deep scratches on the rocks at the bottom and sides of an old glacier valley, while the expert geologist sees them so clearly that it seems to him impossible for anyone to overlook them. If a geologist, a botanist, and a practical farmer be taken through the same stretch of countryside, and then each is asked to record what he has observed, it is usual to find each one reproducing a list of observations *characteristic of his own individual interests and expert knowledge.* What is noted readily by one may be completely ignored by the others.

(*c*) ' Howlers '

We can find examples of mistaken interpretations, usually of auditory sense-impressions, in the often amusing schoolboy ' howlers.' A pupil, when asked recently what was the meaning of ' bosom friend,' replied, " A friend you go to the public house with." The teacher had pronounced ' bosom ' as ' boosom ' and the phrase was interpreted by the child as ' boozing friend.' [1]

The effect of many amusing anecdotes depends upon the fact that a wrong interpretative schema is deliberately suggested in advance to the listener.[2]

[1] During a recent conversation, a speaker said that she could never understand, when a child, why ' bacon powder ' should be put into flour for cooking purposes.

[2] Consider the following :

GRANDMA (*to Dorothy, aged ten years, who has just entered the room*). Hello ! Where have you been this afternoon ?

D. I've been for a walk with some visitors. Grandma, you ought to have seen the ' Devil's Gorge.'

G. Hush, Dorothy ! How can you be so rude ? I'm certain it was only healthy appetite.

THE CONDITIONS OF CLEAR AND ADEQUATE PERCEPTION

It follows from the previous discussion that perception may be clear with respect to the reception of sensory impressions, but at the same time inadequate with respect to the interpretation and comprehension of their significance. In Fig. 2, the lines of each diagram may be perceived clearly while its significance remains vague. Hence for satisfactory perception, two sets of conditions must be fulfilled :

Physical Conditions

(*a*) Sense-organs in good working order.

If sense-organs are impaired then the material presented to the would-be observer for interpretation is obscure, or partial (as in colour-blindness).

(*b*) Experience must be apprehended through a full complement of sense-organs.

This is a most important condition. The traditional five senses, touch, taste, smell, hearing, and sight, by no means exhaust the range of sensory apparatus known to modern psychologists. In the skin there are receptors for touch, pain, and temperature (heat and cold). The ears contain sense-organs for indicating the position of the head and direction of turning, as well as those for hearing. The former are located in the semicircular canals and play an essential part in maintaining body-balance. In the muscles, tendons, and joints are located the kinæsthetic sense-organs which enable us to perceive the positions of the limbs, the amount and direction of movement, and muscular strain. The kinæsthetic sense enters into all kinds of skilled movement, and helps in the perception of distance, size, solidity, and weight.

For adequate perception it is essential that *all the range of appropriate sensory apparatus shall have been exercised.* Too often school-work is confined to experience obtainable through eyes and ears alone. The result is that school-experience feels 'thin.' It lacks the variety and massive quality of out-of-school experience in which the whole sensory apparatus is usually active, including the kinæsthetic senses. Children should be able to move themselves, to manipulate common objects and come into contact with their environment by means of as great a variety of sense-impressions as possible.

(*c*) Good health and physical tone.

Malnutrition, excessive fatigue, inflammation of mucous membranes, adenoids, septic conditions of eyes and ears, all prevent clear perception and retard mental development. Mental retardation due to bad sight and hearing is sometimes confused with feeble-mindedness. In so far as systematic physical training and organized games raise the general physical fitness of the body, including the nervous system, they contribute to a great extent to mental development also. Good health increases alertness.

Mental Conditions

(*a*) Interest in the situation observed.

This depends primarily upon primitive hungers and needs. The interest produces alertness, organizes attention-adjustments, lowers the threshold of sensitivity of sense-organs, and leads to the direction of mental activity upon specific details of the situation to be observed.

(*b*) Specifically directed mental activity.

This condition for correct and adequate perception is most important in teaching. Unless attention is directed specifically towards them details will not be noted although the sensory stimuli are present. This is shown by the non-perception of errors in spelling when attention is directed towards the meanings of the words, instead of towards their appearances.

(*c*) Organized knowledge about the situation perceived.

The more varied and well-organized the observer's knowledge about the situation observed, the more adequate will be the perception in any given case. In the first place, since names play an important part in observation, the more names known by the observer, the more details will he be able to search for (see condition (*b*) above).[1] In the second place, the greater the amount of organized experience possessed by the observer, the more exact and full will be the interpretation of the significance of each detail noted.

(*d*) A correct and adequate mental ' set ' in relation to what is observed.

By a mental ' set ' is meant the system of ideas most active in the mind at the moment of observation.

I had been reading in a newspaper about the League of Nations, then glanced at a book-review on the same page. I interpreted the

[1] *Cf.* Fox's experiments on observation, p. 222.

book-title as "Warning to Nations." The review, however, had no relation whatever to international politics, so, puzzled, I looked again more carefully at the title. This time it appeared as "Warning to Wantons."

The influence of mental set upon interpretation of significance is illustrated frequently by the headings in 'tabloid' journalism. "Tie for Golf Prize" might mean that the successful competitor had been presented, for his pains, with a neck-tie; or that two competitors had made the same score. Which interpretation occurs will depend upon the system of ideas uppermost at the time of reading.

SIGNIFICANCE OF THE ANALYSIS OF PERCEPTION FOR TEACHING-PROCESS

It is obvious that the analysis of perception just completed has a close connexion with methods of teaching. The first duty of the teacher in encouraging intellectual development is to make the child's world as fully as possible *intelligible* to him. In other words the child must be able, quickly and accurately, to interpret a large number of common objects when these are met with in everyday life and in school.

We have seen how correct and adequate interpretation depends upon the variety and extent of the observer's *first-hand acquaintance*, through the sense-organs, with the material environment. Hence *the basis of all intellectual development must be a rich and varied first-hand experience.* There is no possible substitute for this, but unfortunately it is just in this respect that most of our orthodox junior and post-primary schools are lacking. Modern infant-school teaching and equipment are far in advance of those of the junior schools in this respect. If the foundations of first-hand experience have been well and truly laid in the infant and junior stages, such experience is not so necessary in the post-primary stages. Nevertheless, even there, the orthodox school is much too verbal in its methods of presentation.

In the second place, it is equally obvious that since correct interpretation depends upon the pupil having a correct mental set at the time of observation, the teacher must at all times take pains *to induce the correct mental set in the minds of his pupils at each stage in his lesson-development.* We shall merely note the importance of this fact here. How the mental set can be induced will be indicated in a later chapter.

Thirdly, among the most frequent and extensive classes of objects a school-pupil is called upon to interpret are those artificial

conventional objects we call words (both spoken and printed), maps, and diagrams. This brings us naturally to the consideration of the psychological processes involved in such interpretation, which will be undertaken in the next section.

B. Experiencing at Second Hand. Interpretation of Words, Diagrams, and other Conventional Symbols

SUBSTITUTE-EXPERIENCE

One great difficulty in teaching is caused by the fact that some school-subjects must deal with situations which are outside the range of the pupils' possible first-hand experience. This is particularly the case in history, since all but a minute fraction of historical events have happened either before the birth of the learner or outside the range of his experience at the present time.[1] It is impossible, therefore, to give the present-day pupil any direct experience of them. The same difficulty exists in connexion with geography. Many elementary- and secondary-school pupils have never travelled beyond the boundaries of their own county, and the majority have never been to any foreign country. It is still possible to find children in remote hilly districts who have never seen a train, and many in the midst of large towns who have never seen the sea. It is obvious that with the best will in the world, geography teachers cannot bring the Arctic Regions, or China, or the South Sea Islands into the classroom. Nor can they take all their classes to these places. To a less extent the same difficulty presents itself in the teaching of natural history. Lions, tigers, elephants, whales, tropical forests, foreign birds, and so forth, cannot be had even for the asking. It is true that some more fortunate children can visit zoological gardens, and dead specimens may be seen occasionally in museums. Even so, many pupils cannot enjoy so much as these restricted substitutes.

When immediate first-hand experience is impossible the teacher may in some cases present *substitute-experience*.

The most satisfactory forms of substitute-experience are provided by pictures[2] and models. Excellent pictures for history, geography, and nature-study may now be obtained. Also, there is an increasing number of educational cinema-films at the disposal of education authorities. These aids should be considered as a

[1] *Cf.* a political revolution in contemporary Russia in relation to an English-speaking native of New Zealand.

[2] Particularly cinema-films.

necessary part of school-equipment ranking much higher in importance in the earlier stages of learning than books.

One still finds the impression that a stock of pictures, moving or still, and the means to store and display them effectively, constitute a luxury which may be indulged in with strict economy if any funds are left over from what are thought to be the essentials of school-equipment. Very frequently we find schools which possess a piano used for playing march-tunes to keep the pupils in step when they enter and leave the classrooms, hymns for morning assembly, and songs for the music periods once or twice a week. This is considered to be eminently satisfactory, but a small cinema projector or epidiascope, which could be obtained for the price of a piano, is looked upon as an impossible luxury. One suspects that we have not yet rid ourselves of the suspicion that looking at pictures is a sinful waste of time to be tolerated on Sundays when no real work should be done.

Models, again, are essential parts of school-equipment particularly valuable for history, geography, and the less accessible aspects of nature-study and science. A good deal of the more advanced work in biology, chemistry, and physics is concerned with things too minute to be observed with the naked eye. In some cases they are difficult or impossible to follow even with powerful microscopes. Pictures or models which magnify the natural objects many times and display them for class-teaching purposes are therefore desirable.

A word of warning is indicated here concerning these forms of substitute-experience. They are not direct first-hand experiences, and in the absence of a background of actual first-hand experience, pictures (even cinema-pictures) and models may not be intelligible to pupils. This point may be tested by noting the reactions of younger children to pictures and models. The picture and model are seldom life-size. The picture is a two-dimensional, flat representation of solidity. Hence the picture and the model need interpretation.

This is particularly the case with historical material. Even ruins (*e.g.*, of a feudal castle) may be quite ineffective as a teaching-device, unless the pupils have a general educational background sufficient to enable them to imagine the ruin in the setting of its contemporary historical situation. Without adequate preparation, a ruin may convey to pupils no more than the experience of a bewildering collection of crumbling blackened walls having no further significance.

INTERPRETATION OF WORDS AND SYMBOLS

Even if he possesses a rich supply of pictures and models and easy access to a well-equipped museum, the teacher still must

depend for communication between himself and his pupils upon *words* in the form of narrative, description, and verbal illustration. Much of the pupil's school-time is spent in the perception of spoken and written words, that is, of conventionalized sounds and shapes. It is important therefore to realize the conditions which govern this aspect of perception.

Consider carefully the following descriptive passage [1] and try to note the mental processes which accompany the reading.

> The Fanö women have a practical but peculiar costume; the thickly pleated skirt has a bright coloured border, while the close-fitting bodice is adorned with embroidery and pretty antique buttons. A folded cotton kerchief and accordion-pleated apron give a daintiness to the whole dress. The headdress, however, gives the most singular finish to the costume. A dark, check-bordered handkerchief tied over a stiff, cambric frame entirely envelops the head. The four ends of this handkerchief are tied in an odd way, two being left upstanding like rabbits' ears.

What meaning does this convey to the reader? In other words, how are the signs—the printed words—interpreted?

Each individual has his own particular modes of interpretation. What is true of one individual in detail may not be true of another. I will therefore indicate my personal reactions to the description. I find myself aware of a succession of images, mainly visual. First there comes a directive mental 'set' or anticipation produced by 'women' and 'costume' in the first sentence. This indicates in advance, in a general way, what is to follow. Consequently, I have a vague image of a woman's figure, a kind of outline sketch, lacking detail. Then details emerge and materialize, as it were, within this sketchy outline as the descriptive words are read. "Thickly pleated skirt" with "bright coloured border," "close-fitting bodice adorned with embroidery," "pretty antique buttons," —all these phrases *reactivate some definite experiences I myself have lived through in the past.* When I read "thickly pleated skirt," I have an image of nuns walking (a frequent experience in my case as there is a convent in the neighbourhood). "Close-fitting bodice" and "pretty antique buttons" bring to mind some old family portraits depicting relatives dressed in the fashions of the 1880s in England. I imagine also a hotel page-boy in his short, close-fitting jacket adorned with a vertical row of bright buttons.

[1] Taken from M. P. Thomson's *Peeps at Many Lands—Denmark*, p. 70, by permission of the publishers, Messrs A. and C. Black, Ltd.

"Accordion-pleated" suggests the appearance of the bellows of a concertina, and this image is followed by the image of a type of skirt sometimes worn formerly by young women when playing at tennis.

These memories are assembled, under the guidance of the author's description and analogies, into a kind of composite 'picture' which is, for me, the significance of this descriptive passage. It is interesting to note that in order to make the significance more certain in detail the author deliberately guides the image-formation by suggesting standard analogies such as "accordion-pleated," "upstanding like rabbits' ears." It is taken for granted that every reader will have experienced actual examples of accordions, and rabbits' ears.

Not all the images are visual. For example on reading "entirely envelops the head" I not only imagine a nun's headdress, but also feel as if I were pulling a piece of cloth round my own head and imagine my head inside it. Again, "four ends . . . tied in an odd way" recalls motor images—the feeling of actually tying knots, and "folded cotton kerchief" produces more motor imagery.

The following points of importance for our purpose emerge from this analysis :

(*a*) The imagery which conveys the meaning of the passage read, is derived, ultimately, from actual *first-hand experiences through which I have lived.* These experiences range over a long period, some being recent, others dating from childhood.

(*b*) In the absence of an adequate supply of such lived experiences, the passage read would be perceived *merely as a succession of visual signs on a sheet of paper, together with the slight movements of inner speech during the reading.* No interpretation and therefore no meaning would be possible.

(*c*) Before any reader can respond adequately to the passage above, he must first have lived through a set of experiences which correspond with those described therein.

(*d*) These pre-perceptual systems upon which the interpretation of the printed signs depends, composed as they are from details derived from each reader's own personal experiences in a given locality, will resemble only approximately, the first-hand experience of the author. Hence it is almost inevitable that there will be, in every case, some degree of distortion in the interpretation due to the purely individual character of each person's experience. The synthesis of imagery which constitutes this experiencing at

second hand can never be more than an approximately-correct substitute for direct first-hand experience.

Note also the fact, frequently experienced, that one or two vivid images, recalled in response to the opening phrases of a descriptive passage, may so absorb the attention and form the nucleus for so vivid and obstinate a picture that all or nearly all the subsequent description is either ignored completely, or moulded according to these dominant images. This fact emphasizes the need for the careful analysis by the teacher of the passage (prose or poetry) in question, to bring out clearly all the significant items, and also a careful *following-up* of the reading or speech to discover what interpretation has been made by the pupils.

The following-up process in teaching will be discussed at a later stage.

Adult students will find it expedient, after reading or listening, to follow up for themselves by deliberately going through the passage in question, item by item, to check up their first impressions and, if necessary, to correct misinterpretation.

(*e*) *There will be as many different interpretations as there are individuals reading the passage, since each one's personal experience is unique.* This fact is important for all kinds of inter-personal communication. How then can we communicate at all by way of speech or writing ? Only when all the parties to the communication refer the same word-sounds or shapes correctly to standard experiences which all have shared in common.

Differences in individual interpretation occur in arguing at cross-purposes. I listened on one occasion to an acrimonious exchange of opinion in a philosophical discussion. One speaker had made an assertion which another speaker immediately described as "nonsense." Then the fun began. Actually the first speaker interpreted 'nonsense' as being equivalent to 'ridiculous' or 'silly,' whereas the second merely intended to indicate that the assertion was non-sense, that is, logically impossible.

It should be noted that we have taken for granted certain other factors in perception, particularly in second-hand experience, namely, the ability to choose from among a great variety of possible images, those which most nearly fit the incoming sense impressions, and also the ability to comprehend, that is to hold together mentally, a number of different details and synthesize them into a coherent whole. The point we wish to emphasize here is the impossibility of *adequate* perception of word-sounds or word-shapes in the absence of the essential first-hand experience, even though the observer's capacities to discriminate, select, and comprehend are adequate.

The statements (*a*), (*b*), and (*c*) above can be confirmed by means of another descriptive passage, with which, it is hoped, readers will be quite unfamiliar. Here it is:

> The olivo-cerebellar tract arises from the inferior olive, crosses to the opposite side in the inter-olivary space, penetrates the other olive without effecting functional connection with it, and then enters the cerebellum through its inferior peduncle. The cerebral cortex sends large descending cortico-pontile tracts to the pons of the same side. Here there is a synapse in the pontile nuclei whose neurons discharge into the opposite cerebellar hemisphere through the tractus ponto-cerebellaris in the middle cerebellar peduncle. The efferent path from the cerebellum to the red nucleus contained within the superior cerebellar peduncle decussates in the cerebral peduncle before entering the red nucleus.[1]

This second passage has been chosen for purposes of illustration, because in spite of its formidable appearance, it is just a straightforward descriptive account of matters of fact comparable with our first illustration on p. 149. Readers partly familiar with the technical jargon of neurology will gather that it has to do with the topography of the central nervous system. They will be able to interpret common verbs, adjectives, adverbs, prepositions: for example, 'arises,' 'crosses to the opposite side,' 'penetrates,' 'here there is,' and so forth. However, even the apparently familiar words such as 'olive,' 'tract,' 'arises,' 'discharge,' 'red nucleus' are likely to reactivate pre-perceptual schemas which are quite inadequate to interpret the intention of the words as used in this context. For the rest, the technical terms remain mere words to lay readers. They have a thin foreign 'feel' about them. They seem strange and repellent. No imagery arises in response to their stimulation. We feel puzzled and dissatisfied with the passage.

It may be noted in passing that this state of mind is more common than we are willing to admit in many unfortunate pupils in our elementary and secondary schools during a considerable proportion of their school-time. In addition, one suspects that it is not unknown even in university students.

This state of mind is very dangerous from an educational point of view since it indicates aversion. Not only is the meaning of the words obscure or non-existent, but the obscurity or blankness is annoying. We tend very strongly to turn away from any further perusal of the passage if it is too difficult and obscure.

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[1] Herrick, *Introduction to Neurology*, p. 215.

In a case like this, voluntary attention is comparatively useless. If we force ourselves to pay attention we experience only word-shapes, or word-sounds, together with an intolerable feeling of strain and boredom. We get a headache instead of a meaning. There is only one way by which a layman could be prepared adequately to interpret the technical description just quoted, that is, by undertaking an extensive training in dissection of human and animal nervous systems, examining specimens of tissue under the microscope, and associating the conventional technical terms with the first-hand experience thus gained. This illustrates the noteworthy fact that a dictionary may be quite a useless piece of apparatus for a child until he has acquired the minimum foundation of first-hand experience necessary for the correct interpretation of the words in the dictionary definitions.

An intelligent boy about ten years old asked me on one occasion for the meaning of some abstract noun in which he was interested. I told him to consult a dictionary. He said he had already done so and it was quite useless, because he had to look up definitions of all the individual words in the dictionary definition itself, and then all the words in each of those definitions and by the time he had followed all those up he would have read most of the dictionary. He added that he was too busy to do all that so would I kindly produce the explanation myself.

The only satisfactory dictionaries for younger children are picture-dictionaries.[1] For schoolroom use these can be made in the form of a card-index.

PERCEPTION AND INTERPRETATION OF DIAGRAMS

What applies to words applies equally well to diagrams. Consider diagrams *A* and *B* in Fig. 6. Every reader will respond to diagram *A* by saying or believing that it represents a man running. Some readers interested in wireless telephony will interpret diagram *B* as representing a wireless circuit. Experts in wireless will at once be able to identify and name the particular type of circuit represented and to picture valve, crystal receiver, variable resistance, variable condensers, reaction coils, telephones, and batteries as they would appear on a bench in the laboratory or workshop. Those entirely unfamiliar with wireless apparatus will perceive some straight lines, some wriggly lines, a circle, and two arrows. They cannot translate the conventional technical signs into direct first-hand experiences of actual apparatus.

[1] See MacMunn, *The Child's Path to Freedom*, p. 109.

Both diagrams represent matters of fact. Diagram *A* is just as much, or as little, like a man running, as diagram *B* is like an actual wireless set. *B* is as easy to interpret as *A* if the observer has adequate pre-perceptual schemas derived from first-hand experience with wireless apparatus.

In teaching-practice, the most careful precautions are necessary in the use of conventionalized diagrams, *including maps*, until their

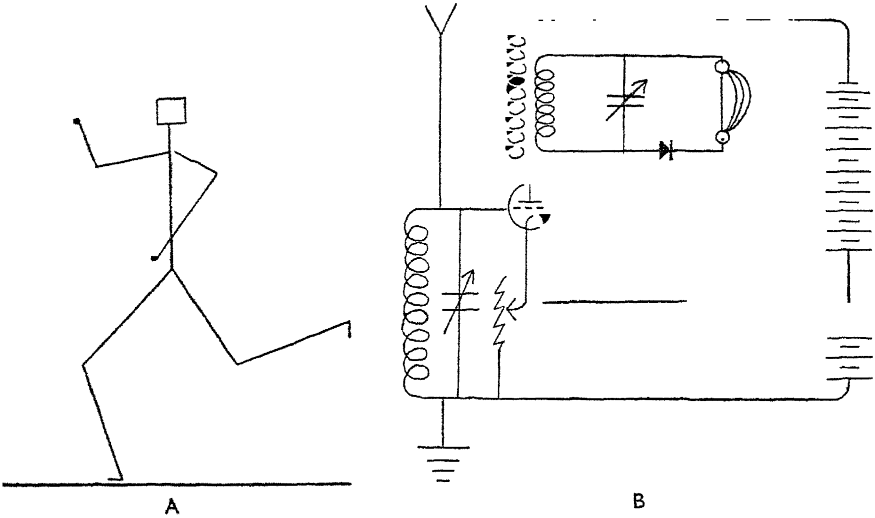

FIG. 6

language has been learned adequately. We may note the following warnings:

(*a*) Never use diagrams as *substitutes* for first-hand experience. Diagrams are useful to *represent and summarize experiences which have already been apprehended directly.*

(*b*) Conventionalized diagrams are quite unsuitable for young pupils. If appropriate first-hand experience is not available for them, pictures should be used.

VERBALISM

Summarizing the discussion in the previous section we may say that:

(*a*) Words (spoken and written) and diagrams are conventionalized objects used to indicate actual experiences. By means of

words and diagrams we can communicate (within limits) our experiences to other people, including pupils.

(*b*) Before words and diagrams can fulfil this purpose of communication adequately, the persons to whom they are addressed must first have enjoyed *at first hand* experiences similar to those indicated by the words. If this condition is not fulfilled the perception of a word or diagram is merely the perception of a sound or shape having no further significance.

Now we can understand what is meant by verbalism. It is a kind of mental disease particularly prevalent in schools and colleges. It is a condition in which experience consists entirely of words and diagrams, for which there exist in the minds of the observers no corresponding associates in terms of things and relations in real life.

The condition arises because pupils are able to memorize accurately, if given sufficient practice, successions of words and diagrams which can be reproduced in the same order as that in which they were learned. Hence, so long as these pupils are required to reproduce the same succession of sounds or shapes, they can give apparently correct answers to questions, and they can simulate intelligence.

Verbalism is dangerous because the sounds and shapes have no significance in terms of real everyday life. They cannot be translated, when necessary, into concrete experiences. *Hence the words and diagrams cannot be applied and used successfully outside of the particular school-context in which they have been memorized.* This difficulty is aptly illustrated by the following story.[1]

> A visitor to a certain school found the pupils 'studying' geography. She was invited by the headmaster to question the class. After glancing at the subject of the lesson she put this question: "If I could dig a very deep hole right down into the inside of the earth, would it be hotter at the bottom of the hole than it is up here?" There was no response. The class was perplexed, and dumb. The headmaster, anxious for his reputation, intervened and said he feared that the visitor had not asked the question correctly. He was quite certain the children knew the answer. He therefore begged that he might be allowed to put the question himself. He said, "Now children! In what condition is the interior of the globe?" The class responded immediately, "The interior of the globe is in a condition of igneous fusion."

[1] Believed to be due to the psychologist, William James.

In verbalism, the word-shapes and -sounds instead of referring to first-hand experience of things become themselves the only first-hand experience the pupil possesses. Since he cannot interpret it, such experience is valueless to him. An extreme case of verbalism would be one in which a pupil repeats mechanically the word-sounds of a foreign language without in the least apprehending the meanings of the words. This extreme form of verbalism is always liable to arise in bilingual areas [1] where the pupils speak their native language in their homes, and at play, while the school-teaching is carried on in another language.

LITERARY VERBALISM

Verbalism is not restricted to the subject-matter of geography, history, or science. It can arise in connexion with the study of grammar and literature. A child eight years old can memorize a catechism such as the following without in the least understanding its import:

> *On the Genitive Case*
>
> QUESTION: Define the genitive case?
>
> ANSWER: The genitive is the case which qualifies nouns like an adjective. It is also used as the direct object of nouns and adjectives, and as the indirect object of certain verbs.
>
> QUESTION: Distinguish between the subjective and objective genitive?
>
> ANSWER: The subjective genitive is a genitive dependent on a substantive, and regarded as the subject from whence that substantive proceeds, as Amor Dei, *the love of God*, that is the love which *God* has *for us* (where God is the subject who loves).
>
> The objective genitive is etc., etc.[2]

Such memorizing can be done before the young learner has any insight into the reasons why there should be a genitive case at all, to say nothing of the reasons why it should be necessary to distinguish between a subjective and objective genitive! Pupils in this condition are in much the same difficulty as those previously referred to who could repeat that the interior of the globe is in a state of igneous fusion, but who had no notion at all that the interior of the earth is so hot that even rocks and metals melt in it.

[1] *E.g.*, in rural districts in Wales, and in the Flemish area of Belgium where the official language of school-instruction used to be English or French.

[2] See J. B. Allen, *An Elementary Latin Grammar*, Last Edition 1898, Reprinted 1930, p. 97.

In the natural order of development, people learn to speak, and then to write a language because they need speech and writing to express their wants, and their feelings, because they must communicate with one another. They do not begin to *reflect* about formal grammar until a later stage when accuracy of meaning and fitness of expression become important. At this later stage the need for a study of the rules of correct speech, and the benefits to be obtained by classifying and systematizing the rules, is realized.

Similarly the adequate study of literature must be rooted in first-hand experience. A good novel or play is a description of people, their reactions to one another and to the physical and cultural environment. The author portrays ambitions, successes and failures ; joys, hopes, fears, and despair. His success (from a literary standpoint) depends upon the accuracy with which he portrays human personalities and their interplay. But, before the reader can enjoy and appreciate a novel or play, he must, to some degree, have lived through, enjoyed, and suffered experiences comparable to those portrayed in the literary work. One's own inner life is therefore the essential first-hand experience in the study of literature. It follows that literary subject-matter, both prose and poetry, should be chosen to suit the age and experiences of the pupils.

The appeal of poetry is two-fold. The sounds and rhythm of metrical speech are themselves intrinsically interesting. Also, the poem, if successful, arouses in the hearer or reader feelings and attitudes similar to those experienced by the poet himself.

Hence we cannot expect full appreciation of poetry until pupils are mature enough to have experienced in some degree the subjective feelings as well as objective situations depicted.

If the study of language and literature is to have real educational value, and particularly if it is to stimulate pupils' imaginations, the following conditions must be fulfilled :

(*a*) The grammar must arise out of, and be closely connected with, the need for clear expression and communication of thoughts and feelings.

(*b*) The literary works studied at any stage of the course must have sufficient connexion with the pupils' own experiences of life.

(*c*) First-hand acquaintance with a *variety* of literary works of merit must precede any treatment of the principles of criticism and canons of literary style.

In science and craftsmanship, first-hand observation of natural

objects and events, or actual practice in the making of things provides the essential foundation for reflection about principles. Similarly in literature, original works of writers of merit must be the foundation of study. *The essays, novels, poems, are the facts of literature.* It is necessary to stress this point since it is not uncommon to find secondary-school and university students preparing for examinations in literature by memorizing, in a sweat of anxiety, neat little text-books *about* Keats, Shelley, Goldsmith, and the like, wherein are set down the date of the author's birth, his school, his family relations, when his works were published, and what Mr X (the author of the text-book) has been able to gather concerning what the various experts in literary criticism believe that Keats, Shelley, etc., meant to say, and what students ought to believe about the merits or demerits of the work. Apparently, reading the original works is quite superfluous; or one gathers that it is allowable only if the student can find the time for it without interfering with his real work!

REVOLT AGAINST VERBAL INSTRUCTION

This is expressed in the time-honoured slogan—"Things before words."

It must not be supposed that the revolt against verbalism is modern. It is one of the recurring refrains of educational history. A history of teaching-method would be an account of a struggle between a few outstanding reformers and the mortifying institutionalism of school-systems. Schools and schoolmasters—as a class—have seemed fatally predestined to settle into a rigid linguistic conformity with tradition. The Renaissance, in so far as it affected educational principles and practice, was a revolt against linguistic pedantry which had reached a fatuous limit in the practice and theory of the so-called Ciceronians, who wished to remove from the school curriculum everything which did not admit of being discussed in Cicero's recorded words![1]

As an alternative to this, Vittorino da Feltre (1378–1446) organized a 'modern' school in Mantua in which he taught the literature, history, and civilization of the Romans instead of the mere form of their language: literature dominating while dialectic and grammar were subordinate.[2]

[1] See Monroe, *Text-book in the History of Education*, p. 372; Adamson, *Short History of Education*, p. 126.

[2] Monroe, work cited, p. 376.

Comenius (1592–1671) wanted children to study things before words and indicated in his *Great Didactic* how this could be done. However, the most shattering attack on verbalism was launched by Rousseau. "The pedagogues," he wrote, "what do they teach? Words! Words! Words!" [1]

THINGS WITHOUT WORDS

Largely due to the influence of Rousseau's doctrines, attempts have been made to introduce more and more activity and first-hand experience into educational practice. Pestalozzi and Froebel attempted to implement Rousseau's ideas in the teaching of young children, and a notable, but not so frequently noted contribution to the same movement was made by the Edgeworths.[2] Seguin and Itard, two French medical psychologists, pointed out the value of practical activities in the education of the feeble-minded, and their work was the direct inspiration for Madame Montessori. Dewey, an American philosopher, has developed systematically the principle that we should not merely introduce some activities into education but that activity is education.[3]

As usual, the intensity of the reaction from verbalism in teaching has led to extreme views in the opposite direction. Rousseau asserted "Give your scholar no verbal lessons. He should be taught by experience alone." [4] Some more modern enthusiasts for the 'heuristic' method have tried to make their unfortunate pupils find out everything for themselves.

Thus from nothing but words, pedagogues have tried to use no words at all. But it is just as foolish to try to teach by experience alone as by words alone. As we shall see in the next chapter, experience and words are both essential, in due proportion, in intellectual development. Without words the pupil is prevented from transcending his immediate, concrete, perceptual experiences. He cannot proceed to well-developed abstract ideas and general principles, without which science and mathematics as well as ethics are impossible.

Hence we must aim at developing an adequate vocabulary along with perceptual experience. At all times the pupil should be able to translate mentally his experiences into words and

[1] *Emile* (Everyman's Library edition), p. 37.

[2] See *Practical Education*.

[3] *Democracy and Education* and *New Schools for Old*.

[4] *Emile*, p. 56.

symbols, and his words and symbols into experiences when such translation is necessary. When the child with sufficient mental aptitude can generalize his experiences and represent the generalizations by appropriate words, it is just as bad practice educationally to make him continue to use concrete materials as it is to make the backward child try to think in abstract terms.

WORDS AS FIRST-HAND EXPERIENCES

Before closing this section we must note certain cases in which words themselves are objects of perception, having definite characters and relations as important for certain branches of study as the characters and relations of material objects are for natural science.

Words are first-hand experience for the student of phonetics. In this case the sound-characters are the significant elements. The expert in phonetics studies word-sounds, and endeavours, among other things, to formulate scientific principles concerning the evolution of word-sounds and the changes which occur in common pronunciation (*e.g.*, Grimm's Law).

Words are first-hand experience of immense interest to the literary stylist. In this case the interest lies in selecting words not only because they have a meaningful significance relative to the theme which is developed by the author, but because they have different sound- and stress-values. Therefore care must be taken to choose words which harmonize in sound and rhythm with their context. Word-sounds and stresses are as important to the literary artist as colours to the painter, and characteristics of different materials to the sculptor.

Words are first-hand experience to the etymologist. Etymology is in some respects a natural history of words. It deals with their origin and evolution, just as natural history of animals deals with the origin and evolution of modern forms of living creatures. A collection of specimens such as *fenestra* (Latin), *finestra* (Italian), *fenster* (German), *fenêtre* (French), and *ffenestr* (Welsh) is as interesting to the etymologist as a collection of five similar but not identical beetles is to the entomologist. Moreover, it raises similar problems of origin, development, and connexion. It is interesting to note that there are fossil words, as well as fossil plants and animals.[1]

[1] See Trench, *The Study of Words*, Chapter I.

Exercises

1. Make a study of a set of typical 'howlers' and endeavour to diagnose the probable cause of the mental confusion exemplified by each 'howler.'

What is the bearing of your study upon presentation in teaching?

2. Collect and analyse errors, omissions, and distortions in children's perceptions of objects and words.

3. Compare the imaginative picture you have made from descriptions concerning some person, building, sea-side resort, etc., with the actual experience of the object or place obtained later.

4. Collect some instances of verbalism in school-pupils and fellow-students. Can you find any instances in your own case?

5. Note as carefully as you can, all the mental processes which you experience when someone asks you, "What is the meaning of justice (life, motion, Mendelian inheritance, spiritual, quanta, etc., etc.)." How do you 'explain' the meanings?

Books for Further Reference

BARTLETT: *Remembering.*
COMENIUS: *The Great Didactic.*
ARMSTRONG: *The Teaching of Scientific Method.*
JAMES: *Principles of Psychology.*
JARVIS: *Froebel's Education by Development.*
,, *Froebel's Pedagogics of the Kindergarten.*
EDGEWORTH: *Practical Education.*
FROEBEL: *The Education of Man.*
McDOUGALL: *Outline of Psychology.*
STOUT: *Manual of Psychology.*
MONTESSORI: *The Montessori Method.*
,, *The Advanced Montessori Method.*
ROUSSEAU: *Emile.*
TRENCH: *The Study of Words.*
McMUNN: *The Child's Path to Freedom.*
STOUT: *Analytic Psychology.*
OGDEN AND RICHARDS: *The Meaning of Meaning.*
RICHARDS: *Interpretation in Teaching.*
CHASE: *The Tyranny of Words.*

CHAPTER VII

ORGANIZATION OF EXPERIENCE—ABSTRACTION, GENERALIZATION, AND ALLIED TOPICS

We have now to consider a topic of the greatest importance for post-primary school-work, namely, how perceptual experience is generalized and organized into systems of knowledge.

The topic affects post-primary education more particularly, since that is the stage in which the systematizing of experience is the predominant aspect of mental development, just as the acquisition of a rich varied store of first-hand experiences should be the predominant characteristic at the infant and junior stages. This is not equivalent to saying that no new experience is acquired during the post-primary period, but that the interest of the adolescent is directed more towards the systematizing than the acquiring aspect of mental development.

The topic is important in general education for another reason, namely, that it has been unduly, indeed rather shockingly, neglected in recent educational thought and practice. There was a period during which educationists acted on the principle that education was *nothing but* intellectual development. Problems of feeling, emotion, and interest were ignored in theory and despised or neglected in practice. However, more recent psychological work, notably in the study of nervous disorders and insanity, has proved beyond doubt that feeling, emotion, and conation are decisive in determining conduct. As a result (as we noted in the case of verbalism) educational theorists have swung violently from one extreme position to its opposite, and some would have us believe that there is nothing of importance in education but feelings and emotions.

Consequently, there has been in practice a lapse into a rather sloppy, 'Rousseauesque' sentimentality in which good intentions have taken the place of logical thinking, sound scholarship, and intellectual discipline. We have shown in a previous chapter that ideas—the intellective elements in mental activity—are not the causes of behaviour. They are acquired in the service of the drives

of hungers and aversions. Nevertheless, although ideas are not the prime movers in human behaviour, they are most certainly the directive and adaptive elements in it. Motive without ideas is blind and wasteful, just as ideas without motive are powerless.

It seems, therefore, that we cannot educate even the feelings and emotions without taking the directive intellectual elements also into account. In this, as in all other human problems, we must take account of the whole living organism in one complex functional system. This will become even more apparent when we discuss sentiments and complexes and their relation to character-formation.

The Nature of the Problem to be discussed

The speech of primitive people and children seems to indicate that their thought-processes are concerned mainly with images and ideas which resemble mental 'pictures' of concrete individual objects, *e.g.*, "Farmer Smith's piebald horse that's grazing in the paddock behind his house." Some of the words in this description are capable of being used in a general way, but the mental 'picture' intended is obviously that of a particular concrete situation with which both speaker and listener are actually acquainted at first hand.

It is obvious that such a concrete mode of thinking is cumbersome, and suitable only for a relatively simple and restricted environment. Progress beyond this low level of thinking is possible only in terms of logical classes and generalized relations. Compare the description just given with "A horse in a paddock, behind a house." This has lost all its concreteness. It will apply equally well to an indefinite number of possible situations, the material details of which may differ in every individual case. 'Horse,' 'paddock,' 'house', now signify only certain *essential characters common to all the objects included in the classes specified by the names.* 'In' and 'behind' signify classes of relations in space. Really, the statement is now very much like a general formula, *e.g.*, $x=a-b$, except that the relations specified in the description are not so precisely defined as those in the formula.

The problem we have to discuss is, how we proceed from the experience of concrete perceptual objects and situations to a knowledge of abstract characters and relations systematized into logical classes.

Principles of Cognition

This problem of intellectual development—how we pass from perceptual experience to the knowledge of logical classes—has worried philosophers and psychologists for ages. It has been generally agreed that the process involves analysis and synthesis of some kind. Somehow or other we must take our first-hand experiences to 'pieces' (mentally of course) and put the 'pieces' together again. That much has seemed fairly obvious. The difficulty has been to discover exactly what the 'pieces' are, and how the dividing and putting together are actually accomplished.

Two English thinkers, Stout and Spearman, have made notable contributions to our modern ideas about the matter. Advanced students can follow up the present introduction by studying their work.[1] Here we shall give a brief résumé of Spearman's noegenetic principles, as a clear understanding of them and their implications is necessary for the topics discussed in this and the two succeeding chapters.

Spearman's object was to discover certain principles of cognition which should be as fundamental for intellective activity as Newton's laws of motion are for physical activity. He suggested three such principles :

(i) *Apprehension of Experience*

Any lived experience tends to evoke immediately an awareness of its characters and of its experiencer.

(ii) *Eduction of Relations*

If two or more characters, simple or complex, are presented mentally, this tends to evoke immediately an awareness of relation between them.

(iii) *Eduction of Correlates*

Mentally presenting any character, together with any relation, tends to evoke immediately an awareness of the correlative character.[2]

MEANINGS OF TERMS

It is desirable to know, first, exactly what is intended by the key terms used in the above statements :

Experience is that which is lived through, enjoyed, or suffered—the usually accepted meaning of experience.

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[1] Stout, *Analytical Psychology* (2 vols) ; Spearman, *The Nature of Intelligence and the Principles of Cognition.*

[2] A simplified and illustrated treatment of Spearman's principles is to be found in Thomas, *Ability and Knowledge.*

Immediate means 'conveyed directly,' that is, without any intervening processes. So soon as an experience is presented then we become aware of characters and relations within it.

A *character* is any feature or quality of an experience which serves to distinguish it from other types of experience. Hardness, rigidity, elasticity, extension, weight, are some characters of our experience of a steel bar. Rectangular, triangular, circular, cylindrical, cubic, are some characters of our experience of extension. Colour is another character of extension.[1] Red, blue, green, etc., are characters of colour. Dark, light, saturated, are characters of any given colour, *e.g.*, red.

Thus any experience can be analysed into a number of elementary characters.

A *correlate* is any item of experience (character or relation, whether simple or complex) which has a specified relation to a given item.

EXAMPLES OF THE SECOND AND THIRD NOEGENETIC PRINCIPLES

Eduction of Relations

The second noegenetic principle may be illustrated in very many ways. It operates most readily when we apprehend experiences together, or in close sequence. I can see in front of me two books, a big red one and a smaller blue one. My experience of this situation is not an experience of red, blue, rectangular, etc., as distinct and separate experiences merely juxtaposed. It is rather that of a *total situation* made up of a *complex of characters and their relations*. I see red and blue, but at the same time, *even though I may not know the names of the colours*, I apprehend immediately as a factor in the experience a relation of colour difference. Again I apprehend the two books as related in thickness; one is thicker than the other. Also one is taller than the other. They are related in position—one is by the side of the other.

Even in so apparently simple a case as this, more complex and subtle relations can be apprehended. One book is standing vertically upon the table. 'Vertically' signifies a space-relation between book and table. The other book is also standing vertically on the same table. Hence we can educe a relation *between these two relations themselves*, that of similarity. As the experience develops, still more subtle relations emerge, and form the *fundaments*, or bases, for further relations. I note the titles of the two books. Each title, as we saw in the discussion of word-meanings,[2]

[1] To save tedious repetition, the words "our experience of" will be taken for granted.

[2] Chapter VI, p. 148.

implies a system of relations. These two titles have the relation of difference from the point of view of the actual words used, size of letters, spacing of letters, etc., but the relation of similarity from the point of view of import. The titles indicate that both books are concerned with psychology.

Similarly with tones on a musical instrument. If someone strikes middle C on the piano, and the same note again a moment after, we apprehend the two experiences as the same from the point of view of pitch, but different or similar from the point of view of loudness; and as related in sequence (one after the other) from the point of view of time. If someone sings first *doh* then *me*, we apprehend among other relations the musical interval between them. If we now hear *me* and then *soh* we can compare the musical interval between *doh* and *me*, with that between *me* and *soh* and apprehend a difference; one is a major, the other a minor third. This is a relation between relations.

In this way a melody or a fugue is not so much a collection of notes from a musical instrument as a complex system of relations of time, rhythm, pitch, timbre, loudness, and so forth.

Eduction of Correlates

The third principle embodies that aspect of cognition which enables us to proceed from past and present experience to future possibilities before these can be realized actually. By virtue of the fact that we can educe correlates, we are able to create knowledge in advance of events and anticipate time. In this way discoveries and inventions are made in science, and mathematical systems produced often long before anybody can say whether they will have any practical applications.

The principle may be illustrated as follows. When we have had some experiences of number, we apprehend such relations between quantities or objects as two more, twice, five times, etc. Now, if we are presented with a fundament, say, 'three,' and a numerical relation, 'two more,' we immediately know the correlative fundament—five. If the fundament is ten, and the relations given are five more, twice as big, a half of, three less than, then we can educe (or predict) the correlative fundaments fifteen, twenty, five, seven.

In music, if we are given a note, say, *doh* and an interval (pitch-relation) of a major third, we can play or sing the note *me*. If the original notes played or sung were *doh* and *me* we can repeat

the same interval (predict the correlative note) starting from any other given fundament. On a higher level of complexity we find the same principle illustrated in transposing a melody. We may have learned to sing or play the National Anthem in the key of G major. Now suppose we are given a *new* fundament, the key of E flat major, and the *same* system of pitch, time, and rhythm relations, we can sing or play the correlative, in this case the National Anthem, in the new key.

Geometry again is concerned with systems of space-relations. We apprehend two triangles and a relation of congruence. If we are then presented with any particular triangle and the relation 'congruent,' we can educe the correlate, *i.e.*, a second triangle of a specified kind.

It may be objected that this correlate-eduction is due to habit. This cannot be so, since an intelligent person can educe correlates which have never occurred before in his experience. This frequently happens in scientific thinking.

SOME TYPES OF RELATIONS

Since our purpose as teachers is to guide the intellectual development of pupils, it is desirable to have a clear notion of the commoner types of relation. It is impossible here to do more than offer a few suggestions for the sake of guidance. There is a good deal of controversy about the exact classification of relations, and to treat the topic thoroughly would need several volumes. Readers interested can follow up their study in some of the standard books on logic and scientific method. The following should be known:

Attribution, that is, 'belonging to,' *e.g.*, relation of warmth to fire; coldness to ice; hardness to steel. Attributes are essential characters of objects.

Constitution, that is, of parts making up or constituting a specific whole. Compare the arrangement "man there the is" with "There is the man." The first is a collection of words, the second a logical unity. In the second case besides certain space-time relations each word has a constitutive relation to the sentence as a logical unity.

Space and Time, *e.g.*, juxtaposition, distance, direction, simultaneity, sequence. Shape is a complex set of relations of juxtaposition, distance, and direction. Motion is another complex space-time relation.

Magnitude.

Causality (or cause and effect).

Identity, Equality, Similarity, Difference.

Conjunction, e.g., $5+7$; two and two; a man and his dog.

Evidence.

These are found in reasoning, proof, logical demonstration. Examples will be given in the section on reasoning (p. 212).

Relevance.

These relations are most important in all kinds of practical affairs and in mathematical and scientific theory. If we look casually at a perceptual situation it presents a large number of possible characters and relations in none of which are we especially interested. However, if we have some definite purpose in observing, some of the characters and relations now become more significant than the others because they are *relevant* to, or have some bearing upon, the purpose in which we are interested.

During the passage of the Deceased Wife's Sister Bill through Parliament, a pompous and officious lawyer was asked, "Is it possible now for a man to marry his widow's sister?" Anxious to be useful, and air his knowledge, he launched immediately into a detailed exposition of the Bill in question. Unfortunately, he had missed the precise implication of the term 'widow,' and, of course, all his information was irrelevant. It had no bearing upon the question asked.

Students frequently fail to judge correctly relations of relevance in answering examination questions. They will persist in answering questions they set themselves instead of the questions actually on the paper.

The ability to recognize relations of relevance is one of the 'acid tests' for intelligence, and one of the main characteristics of genius. Many people had speculated about the space and movement relations among the objects constituting the solar system, but it remained for Copernicus to realize the relevant relation, namely, that the sun is the centre round which the planets, including the earth, revolve. The acuteness of this notion was all the more remarkable since it seemed quite contrary to all the visible evidence.

DISTINCTION BETWEEN ACCIDENTAL AND NECESSARY RELATIONS

Suppose we are given a box containing nine digits, 1, 2, 3, 4, ... 9, printed on separate cards. We are told to shake the box well,

take out the cards one by one, and arrange them in order from left to right *as they come out.* The first attempt might yield

9 1 4 7 6 8 3 2 5.

If we throw them back and try again we might get

3 7 4 1 2 5 8 9 6.

We could repeat this time after time and arrange the digits in many thousands of ways. There are quite a number of relations involved in each order, *e.g.*, time-relations in pulling the cards out, space-relations such as side by side, one after or before another, in the middle of, fifth from the beginning, and so on. These relations, however, are *accidental.* They happen *entirely by chance,* and it is impossible to predict which particular order will turn out next.

If now we are told to arrange the digits in ascending order of number-magnitude there is one and only one order possible to comply with the specification, namely,

1 2 3 4 5 6 7 8 9.

Moreover, it does not matter now with which digit we begin, nor in what order we draw them out of the box, we shall arrive at the same order of placing in the end because the relations specified between the digits are now *fixed* or *necessary.* If we draw out a five first, then a three, then a seven, etc., we shall place them in a certain fixed order, leaving spaces to be filled in by the other digits as we draw them out of the box.

Similarly with words. We may arrange a series of words haphazard, for example:

Whipping a an man dog was howling angry.

We find the same kind of accidental space- and sequence-relations as we did with the digits. If, however, we are told to arrange them so as to make a sensible sentence, there is only one way which will comply with the relations implied in the instruction. No matter with what word we begin, nor in what order we select them, we shall invariably finish with

An angry man was whipping a howling dog.

The relations in this case are fixed and necessary.

These logical necessary relations are the ones which enable us to plan and organize, and, in particular, to predict. It is because experiments have shown that amid a crowd of accidental relations among natural events, there are also some necessary, causal, logical relations, that science is possible. Scientific method may be said

to be a set of rules for distinguishing between accidental and necessary relations.

It has been suggested that for the sake of clearness we should mark this distinction between these two classes of relations by calling the logical, causal, necessary relations, *connexions*.

The ability to distinguish correctly between logical causal connexions and accidental relations is another 'acid test' for intelligence. Indeed, some thinkers have defined intelligence as the ability to recognize the *connexions* which are *relevant* to some specified purpose or problem. If this is not a complete definition of intelligence it is a useful practical test for estimating it and most mental tests are constructed on that basis. This point can be verified by examining the questions in any standardized test of intelligence.

PRIMARY AND SUPPLEMENTARY INTELLECTIVE PROCESSES

Apprehension of characters and eduction of relations may be called the *primary* intellective processes since they provide the thinker with his basic raw material for the organization of knowledge, that is, elementary characters and relations. The latter are the 'pieces' into which our perceptual experience must be analysed preparatory to abstraction, classification, and generalization.

In addition we have certain supplementary intellective processes, namely, correlate eduction and reproduction by memory and habit, which *supplement* our present experience.

Correlate-eduction plays a most important part in the educative process. By reason of this ability to educe correlates, when we have apprehended certain fundamental characters and relations in first-hand experience we can then proceed to elaborate, mentally, quite complicated systems of ideas *without recourse to further first-hand experience.*

This fact must be utilized by teachers in any attempt to provide pupils with adequate ideas about situations they cannot experience at first hand. Consider again the description of the Fanö women (p. 149). In the phrase, "accordion-pleated apron," the fundament provided by the reader's own experience (and recalled by reason of the ability to remember) is 'apron.' Relations are specified by the adjective 'accordion-pleated,' and remembered from some previous actual experience. Now, having recalled from our own previous experience certain characters corresponding with 'apron' and the set of relations specified by 'pleated like an accordion,' we can then proceed to supplement our actual experience by educing

the appropriate correlate, namely, an idea of the aprons worn by the Fanö women, *which we have never seen in real life.*

Correlate-eduction is inseparable from the teaching of history and geography. Ideas of situations in foreign lands and past ages, of which the pupils have had no first-hand experience, are all correlates elaborated out of the characters and relations recalled from their own actual experience, according to the specifications in the description. Thus a Canadian prairie may be described as "like hundreds of flat English fields put end to end and side to side without any hedges or walls between them."

It is obvious that if this supplementation by correlate-eduction is to be adequate, it is essential that the pupils shall have gathered a rich, varied, vivid reserve of first-hand experiences. It is in this respect that much of our orthodox school-practice is so woefully inadequate, particularly for the poorer children whose out-of-school experience is so restricted in range.

Habit *facilitates* the apprehension of characters and relations, and the eduction of correlates. The processes take place more quickly and easily on subsequent occasions. This can be verified by examining a puzzle-picture in which one is required to pick out some familiar shape from a medley of irrelevant lines. It usually requires concentrated mental activity for some time on the first occasion, but, once we have grasped the shape clearly, it appears more and more easily as we repeat the performance.

Memory *supplements* the experiences possible at any given moment by reinstating characters, relations, and correlates previously grasped. This process was illustrated in the discussion on the interpretative aspect of perception.

We can now understand in more detail the nature of the interpretative schemas or stereotypes there mentioned. They consist of systems of characters, relations, and correlates habitually associated with the object or word observed.

The nature of the interpretative process is also clear. When we look at an equivocal object, such as the diagram *B*, p. 138, we note certain characters, and some space-relations between them, *e.g.*, black lines irregularly spaced, and drawn in various directions. None of the relations, however, is significant. We cannot, by means of the relations immediately educed from the sensory data presented, produce any correlates which correspond to objects we have actually experienced. Hence the diagram *does not develop.* When a title is suggested, *e.g.*, "The Week-end Out of Doors,"

"Alfresco Meal," "Picnic Party," it gives a clue to the *significant* relations intended. It indicates that the lines in the diagram must be related in the same way as the outlines of familiar objects connected with an open-air meal. We are able to educe the significant correlates—four people sitting or reclining round a cloth spread under a tree. These correlates now fit the sense-data, and the diagram seems to objectify itself and take on a richer meaning.

The reason for distortion and error in interpretation is also clear. In observation we seize upon certain outstanding characters by reason of familiarity. Then these reinstate an habitual mental system which we apply almost instantaneously to the outstanding character actually observed. However, different objects may have similar outstanding characters. Thus our first interpretations may not fit the reality.

We may note again that form of distortion when the opening sentences of a passage of prose or poetry reactivate a strong pre-perceptual system which occupies the 'focus of consciousness' so obstinately that we fail to interpret correctly the significance of the rest of the passage. A similar difficulty may be noted in discussion, and the two people concerned cease forthwith, without realizing it, to talk about the same thing.

A further point also becomes clearer. We noted the differences in observation as between different types of people. They are explained in part, of course, by actual differences in experience. This does not account for all the differences however. The rest is explained by our tendency to select out of a total situation just those characters and relations *which serve our purpose*. Hence our predominant purposes, both practical and theoretical, determine the elements of our experience which will be abstracted and systematized.

How are Characters and Relations grasped clearly? Implicit and Explicit Cognition—Attending, Abstracting, Naming

From the brief discussion of Spearman's noegenetic principles, we have gathered that the primary *intellective* processes are the apprehension of characters and eduction of relations within the first-hand experience presented to us through the sense-organs. These characters and relations are the 'pieces,' or to be more precise the analytical mental elements into which our complex total perceptual experiences must be resolved before we can begin the process of systematizing and generalizing our experience into knowledge.

The question now arises: By what means do we perform the

necessary analysis? We must take note of three processes; namely, concentration and direction of mental activity, abstraction, and naming.

That the analysis of perceptual experience is not automatic, instantaneous, or complete is already sufficiently obvious from the discussion on perception. The environment presents us continually with an enormous number of possible characters and relations. Of these, we *realize explicitly* only comparatively few and ignore the remainder. Mental activity is selective. The very fact that we bring some particular sense-organ to bear upon one aspect of the environment means that other aspects must be ignored. In addition, we have already noted the principle of least action. Our attention-adjustments are controlled by our hungers, and these again are related to our needs. As soon as a need is satisfied, hunger gives way to complacence, during which observation is at a minimum. Hence in normal circumstances we *never proceed with the analysis of our perceptual experience into characters and relations further than is required for the satisfaction of our need at that moment.*

How many pedestrians (not expert motor-engineers) who see cars hundreds of times in a day, can draw accurately from memory the details of any well-known brand of saloon car? (Readers might amuse themselves by trying to draw an "Austin-ten," "Morris-ten," "Talbot-ten" without reference to an actual car or picture. It might be made into a competition to find who can include the greatest number of correct details.)

The need of the average pedestrian is either to ride in cars, or, more frequently, to avoid being squashed flat by them. For these needs the recognition of one or two outstanding characters and relations is ample.

It is more striking to note that many people cannot analyse out characters and relations correctly even when they are observing an actual situation. Give some untrained pupils a map to copy, or a spray of flowers to draw, and note how the result, with which they are satisfied, corresponds with the original. Almost invariably gross errors are recorded, showing that certain characters and relations in the objective situation observed have not been noted explicitly at all, although the original is in front of the observers all the time.

People can, and do, react correctly in a practical way to relations without realizing exactly what the relations in question are. For example, a verbally untrained adult may possess a settee, a sofa,

and chairs. If asked to do so he will point out each correctly, but may be quite at a loss to say what is the significant *logical difference* between these three common objects. A person can walk along a busy street while talking to a friend or thinking about what he will do when he arrives at his destination. If the neighbourhood is familiar he proceeds in the correct direction, avoids vehicles and other walkers, steps up and down kerbs at the correct moment. All this activity implies that the person concerned is reacting correctly to perceptual relations of space, time, colour, sound, etc., yet the relations need not be explicitly realized. These details of the journey may be quite forgotten by the time the destination is reached.

Hence we must take account, particularly for teaching-purposes, of the difference between *implicit* and *explicit* cognition. In ordinary experience, even of educated adults, many details of a perceptual experience remain bound, as it were, within the total situation. They are implicit in the experience and not consciously realized (or explicit). Clearly these implicit characters and relations are useless for intellectual development since by the very nature of things they cannot be organized by the learner. Therefore we must inquire how implicit cognition can be changed into explicit cognition. This change is the essential factor in intellectual development and, as we shall see in Chapter IX, in the transfer of the effects of training.

ATTENDING

The first phase in the passage from implicit to explicit cognition is *attending*.

Attending is the name we give to the complex set of physiological and mental adjustments which bring the sense-organs into the most favourable position for receiving stimuli clearly, and which concentrate the mental activity upon a specific objective (mental or physical).

The result of attending with alertness is a more intense and clear cognition.

How the attending can be started and controlled will be considered later.

COMPARING, CONTRASTING, ABSTRACTING

The second phase is that of comparing and contrasting the fundaments (which may be objects, characters, or relations) and

abstracting the item concerned (which may be a character or relation).

When a character or relation has been singled out and made explicitly conscious it can be thought of as a character or relation in abstraction from the particular perceptual experience in which it was originally embodied. Thus a trained person can think of ' white ' without at the same time thinking also of a piece of white chalk, or a snowfield, or a swan in which he may have noted the character in question originally. In the same way a relation, *e.g.*, ' a distance of twelve inches ' can be thought of without imagining a particular twelve-inch ruler.

Any character or relation which can be thought of apart from the concrete perceptual situations in which it may be embodied is called an *abstraction.*

Comparison and contrast facilitate the process of abstracting. Thus, at first, the whiteness of a piece of chalk seems to belong to the object very persistently. It is conceivable that if we saw no other white objects but pieces of chalk, the abstraction of the character ' white ' would be most difficult or even impossible. However, when the perception of a piece of white chalk is followed by that of a sheet of white paper, a swan, an expanse of snow, white flowers, etc., the fact that the white character is common to all these situations while all of the other characters differ, serves to emphasize the white character and depress the others, particularly if the mental activity is directed specifically to the whiteness. At the same time the whiteness of any given white object can be intensified in cognition by presenting it in close conjunction with other objects not white.

Comparison and contrast are facilitated by presenting the characters and relations in question in close proximity. Separating the fundaments may prevent explicit cognition. (See account of Line's experiments, p. 191.)

It is worth notingfor teaching-purposes that in comparison we direct mental activity towards and emphasize similarities ; in contrast, differences.

NAMING

The process of abstracting is completed (fixed as it were) by naming the character or relation abstracted. Behaviourist psychologists call this naming ' verbalization,' a word of which

they are very fond. For the orthodox Behaviourist there is no such process as thought, only the repetition of word-habits.

How do We arrive at a Knowledge of Logical Classes and Generalizations?

We have followed in some detail the processes by which we arrive at explicit awareness of elementary characters and relations. Now we have to inquire how these elements are reorganized into logical classes and generalizations.

We can study the process by means of a simple example.

Experience presents us with a multifarious *collection* of living things. We begin our mental organization by noting certain striking and predominant characters. Some of the things move, others remain fixed in one place. The first we call animals; the second, plants. Some animals walk on two legs (*e.g.*, human beings and birds), others on four legs. Each broad class includes characters between which we note relations of similarity and difference. We begin to assemble sub-classes of like creatures. Then these creatures, when compared within their class, reveal *significant* differences. Differences in size may not be significant. Some rabbits are bigger than some dogs. Closer examination shows that the rabbits are all vegetable-eaters while no dogs are vegetable-eaters. This difference is *critical*. It serves to distinguish completely all rabbits from all dogs. Then we find that this critical difference is *invariably correlated with* other characters, *e.g.*, kind of teeth, type of digestion, and so on.

Thus, by comparing and contrasting the original objects in the multifarious collection and isolating (abstracting) characters and relations *always manifested by certain only of the individuals and never by the others* we can organize the original collection into a number of mutually exclusive logical classes to each of which we give a name.

To each name there corresponds a definition, that is, a specification of the *essential* characters and relations appropriate to that class.

We classify more than objects. Thus, 'a distance of one foot' is a class of relations. 'Boiling' 'running,' 'thinking' represent classes of activities or processes. 'Poor,' 'rich,' 'healthy' are classes of conditions.

Having arrived at a knowledge of classes, we can note relations between classes. For example, rabbits, sheep, deer are grass-eating

animals. Cats, lions, wolves are flesh-eating animals. All are quadrupeds. Animals and plants are all living things.

Thus, by this process of logical classification we reduce the bewildering multiplicity of our perceptual world to an ordered arrangement which can be organized and reorganized *mentally.* Clarification and organization of the items of experience *proceed concurrently in two directions*, namely, (*a*) the analysis into more and more circumscribed sub-classes each with its own special characteristics; and (*b*) the re-synthesis of many sub-classes into broader groups according to some common feature possessed by all in the group.

Some very clear cases of classification and generalization are presented by grammar (classes of words and sentences); logic (classes of propositions); and the various branches of natural science, *e.g.*, zoology, botany, geology, chemistry, and physics.

SUMMARY

The organization of experience involves two main processes: analysis and synthesis.

In analysis complex perceptual experience is resolved into elementary characters and relations. These elements are brought into explicit awareness by selective attending, and are then abstracted and named.

Concurrently with analysis goes synthesis. Objects (both simple and complex) having the same characters are grouped into classes.

The Actual Course of Intellectual Development in Living Children

We have considered the processes of intellectual development in abstraction, as if they occurred singly. This is never the case in actual life, and to get a truer picture of the teacher's task we must try to make a survey of the normal living pupil in action.

The child's perceptual world is, at first, what psychologists call a 'presentational continuum' or, as William James much more picturesquely phrased it, "one big blooming buzzing confusion." Out of this continuum there emerge first, striking sense-impressions—bright colours, loud sounds, movements. These serve to objectify things with which they are habitually associated.

Thus the first stage of intellectual development is the recognition of individualized objects by means of some striking characteristic which commands the child's attention. The first names are usually descriptions of objects in terms of the predominant character, *e.g.*,

dogs are 'wow-wows'; ducks 'quack-quacks'; carts, motor-cars, perambulators, 'go-go's.'

The predominating mental activity in early childhood is sorting out the perceptual continuum into more clearly defined objects. The object seems to be noted as a crude whole at first, and advance consists of bringing to explicit awareness a constantly increasing nicety of detail. This is very well shown in Figs. 7 to 12.[1] Thus

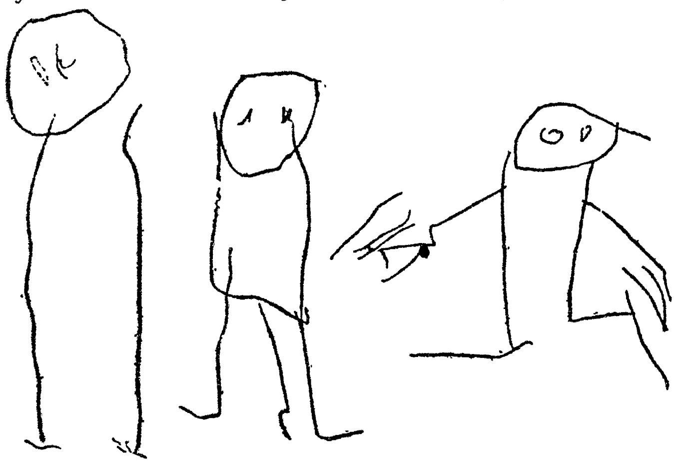

FIG. 7
Bear, Monkey, and Human Being.[2] Age, 4 years 5 months.

FIG. 8
Drawing of a House.[3]
Age, 4 years 9 months.

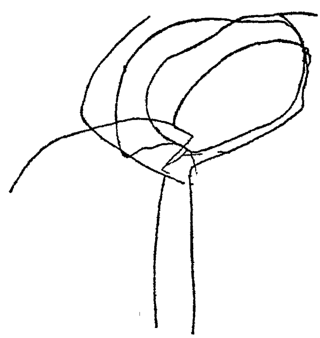

FIG. 9
Drawing of a Tree [4]
Age, 5 years 8½ months.

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[1] Reproduced from *The Psychology of Children's Drawings*, Helga Eng, by permission of the publishers, Messrs Kegan Paul, Trench, Trubner and Co. Ltd.
[2] Work cited, p. 41. [3] Work cited, p. 46. [4] Work cited, p. 57.

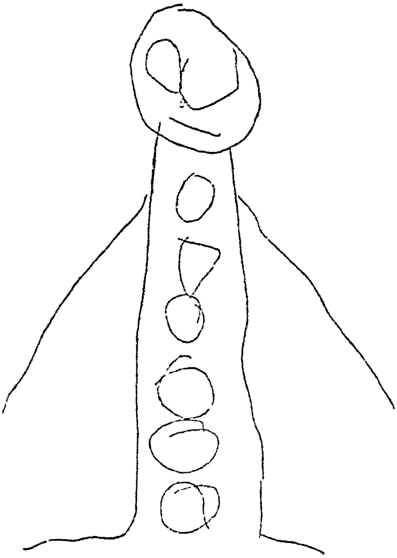


FIG. 10
Drawing of a Lady.[1]
Age, 4 years 7 months.

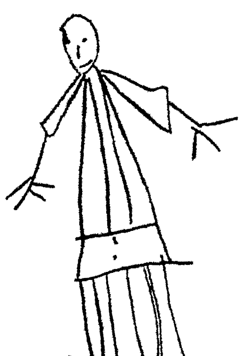


FIG. 11
Drawing of a Lady.[2]
Age, 6 years $2\frac{1}{2}$ months.

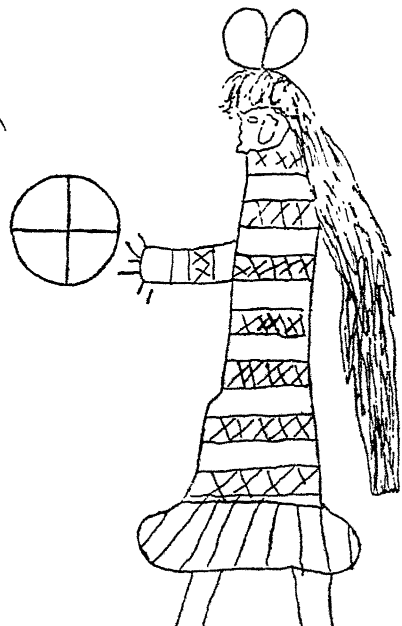


FIG. 12
Drawing of a Girl playing Ball.[3]
Age, 7 years $10\frac{1}{2}$ months.

[1] Work cited, p. 45. [2] Work cited, p. 76. [3] Work cited, p. 176.

the direction of intellectual analysis is from crude wholes of experience to finer and still finer details. These details are not just added together in a mechanical way. They emerge or unfold from the original continuum as the powers of analysis improve and as observation is supplemented by memory and habit.

True classification is a rather later phase than analysis although it has usually begun before the normal child is ready to enter the infant school. The child's first groups are collections of objects rather than classes. In the process of classification, the young child's first perceptual objects represent types. Thus, if the first object seen is the domestic dog, then all similar animals will be called dogs—horses and donkeys will be big dogs; rabbits, little dogs. This again illustrates the fact that the child at this stage perceives wholes (compare the drawings of the bear, monkey, and human being on p. 178).

Here again progress goes from crude undefined wholes to clear details. The types recognized by a general-outline similarity give place gradually to logical classes arranged according to one or a few common elementary characters.

The Relative Importance of Practical Activity and Language in Intellectual Development at Different Stages of School-life

We have seen that the essential mental processes in both analysis and classification are first, concentrated attending, and second, the to-and-fro direction of the attention adjustments (comparison and contrast) which serves to bring different objectives within the same mental field. From the practical teaching point of view we need to realize clearly what conditions determine this alert attending, comparing, and contrasting and how the processes can be directed by the teacher.

In the very first stages of development, attending is stimulated by striking and massive changes in the environment. This reflex attending continues throughout life, but more important for systematic learning is the attending which is motivated by a hunger or aversion.

Needs in the young child lead directly to practical, manipulative activity, the aim of which is to satisfy the need. Now, so long as the practical activity is successful, resulting in satisfaction, attending remains at a low level of intensity. The learner is just

sufficiently aware of the total situation to react successfully in an habitual way. This is the condition of implicit cognition.

The practical, manipulative activity, however, frequently ends in some *difficulty* which prevents further progress towards satisfaction. Then we get *mental arrest* accompanied by some degree of emotion (anger, fear, surprise) and a reinforcement of the hunger or aversion which prompted the activity. The mental arrest and the rise in intensity of conative and affective experience concentrate the mental activity and direct it towards the specific cause of the difficulty, giving rise to *more intense cognition* and *increased clearness* of apprehension.

Thus, a small child in a Montessori school may be provided with a form-board in which holes of various sizes and shapes are cut. Into these holes he is required to fit wooden insets. Suppose he begins with a circular hole. He may pick up a square or hexagonal inset without noting specific features of its shape, and endeavour to force this into the hole. It will not fit. Thereupon he twists it about, possibly hammers it. Still it will not go in. The arrest produced by this difficulty concentrates attention upon the detailed differences between the shape of the hole and of the wrong inset. Thereupon the process is repeated with a second inset—the trial-and-error type of learning.

In normal circumstances social intercourse plays a significant part in the development of a situation like this. The baffled and disappointed child goes to an older pupil or to the teacher. The latter has two alternatives, *depending on the vocabulary of the pupil.* He can point to the root of the difficulty, and then demonstrate the correct solution by doing the trick himself. As he performs the actions he *names* the significant items and thus intensifies the process of abstraction.

At a later stage when the pupil's vocabulary is sufficiently well developed, a description or verbal instruction will serve the same process as practical pointing, and demonstration. A pupil may have drawn a map of Great Britain in which the details are grossly out of proportion. The teacher may say, "Look at England on your map. Now look at Wales. Which is bigger? Now look at England and Wales on your atlas. What is wrong with your drawing?"

Thus mental activity can be directed *either* by practical manipulative activity on the pupil's part, and by pointing, pantomime, or demonstration on the teacher's part, *or* by using words. In

actual practice these two sets of processes are combined, but it is important for teaching-purposes to note their *relative* importance at different stages in intellectual development. It is very obvious that practical activity by the pupil and practical guidance by the teacher must predominate in the early stages of development, since words then have a minimum of significance. Verbal direction of mental activity is useless until an effective vocabulary has developed. This fact is an additional justification for the predominance of practical manipulative activity as an educational medium in infant and junior schools, and among the more backward seniors.

What are the Functions of Language in Intellectual Development?

The importance of verbalization merits a more detailed discussion of the topic. What are the main connexions between intellectual development and the development of a language?

Words act as vehicles for meanings.

Intellectual development depends upon the analysis of first-hand experience into elementary characters and relations. These when abstracted from the concrete objects of experience are the ideas, properly so-called. Now, ideas are elusive. They fade quickly from consciousness. They may re-emerge spontaneously from time to time but are often quite difficult to recall voluntarily. Yet if we are to continue the organization of experience beyond first-order relations and crude classifications we must be able to maintain ideas in the 'focus of consciousness' sufficiently long for adequate contemplation.

Again, so soon as a related system of objects is broken up, the relations in question cease to exist. In the absence of any vehicle for the relations it would be impossible to contemplate them again without reconstituting the precise objective system in an identical way. This is frequently difficult, and it may be impossible (in the study of history, for example).

Hence, for intellectual development beyond the crude stage of perceptual experience we need an efficient vehicle for the perpetuation and mental control of abstract ideas. This is provided very efficiently by words.

Words, both spoken and written, are themselves perceptual objects with the sensory vividness and intensity of material things.

Written and printed words are permanent and relatively constant in appearance, being easily recognized. The motor-mechanisms of speech and writing persist for long periods as habits enabling the trained learner to reproduce a great variety of words at will. Further, by the use of a conventional alphabet, an almost infinite variety of new words can be invented to keep pace with the advance of fresh discovery and analysis.

If, then, we learn associations between abstracted characters and relations (the meanings) and corresponding words, and make the associations habitual, we can by organizing the words also organize the corresponding ideas to a very high degree of complexity and subtlety.

It is a commonplace of observation that if we are looking or listening intently for some object, or trying to solve a complicated problem, we tend to repeat and stress the appropriate words either aloud or in inner speech. Also, the more difficult and elusive the ideas are, the more intently do we stress the words. This motor-activity serves to maintain the corresponding ideas in the focus of consciousness. Occasionally a problem which has resisted solution during quiet contemplation can be solved if the thinker attempts to expound the difficulty to an audience.

It is easy to see that a language made permanent by writing and printing accumulates the wisdom and knowledge of many past generations of thinkers. An intelligent child who can read 'stands on the shoulders' of his predecessors. The extraordinarily rapid progress of mathematics and physical science within recent years would have been quite impossible in the absence of a written language.

A developing language facilitates increasing nicety of characterization and subtlety of relation-eduction (that is, growth in the depth of intellect).

The fact that words are distinct and easily distinguishable objects, facilitates discrimination between two similar but not identical experiences. This function has been very well depicted by William James.

> How does one learn to distinguish claret from burgundy? Probably they have been imbibed on different occasions. When we first drank claret we heard it called by that name, we were eating such and such a dinner, etc. Next time we drink it a dim reminder of all these things chimes through us as we get the taste

> of the wine. When we try burgundy, our first impression is *that it is a kind of claret*,[1] but something falls short of full identification and presently we hear it called burgundy. During the next few experiences, the discrimination may still be uncertain—"Which," we ask ourselves, "of the two wines is this present specimen?" But at last the claret-flavour recalls pretty distinctly its own name 'claret,' "that wine I drank at So and So's table," etc.; and the burgundy-flavour recalls the name 'burgundy' and some one else's table. . . . After a while the tables, and other parts of the setting besides the name, grow so multifarious as not to come up distinctly into consciousness. But along with this, the adhesion of each wine with its own *name* becomes more and more inveterate, and at last each flavour suggests instantly and certainly its own name and nothing else. The names differ far more than the flavours and help to stretch these latter farther apart. Some such process as this must go on in all our experience. Beef and mutton, strawberries and raspberries, odour of rose and odour of violet contract different adhesions which reinforce the differences already felt in the terms.[2]

This process of 'pinning down' each newly developed idea as it emerges during the process of analysis resembles to some extent the practice of the biological student dissecting a complicated animal structure. As each component is isolated clearly from the original complication it is pinned down and labelled, making future identification more accurate and rapid.

If we learn words for characters and first-order relations, then these words help to keep in mind the first-order relations so that second-order relations between them are more easily grasped. These, expressed in words, form the fundaments for third- and higher-order relations. Without the aid of words it is doubtful whether these subtle higher-order relations could be held in mind sufficiently long to make them clear. One frequently finds in considering a new problem that, by pondering over the relations already clarified, more subtle relations emerge, at first very vaguely. They represent more of a feeling than a developed thought. Unless these fleeting subtle higher-order relations can be expressed in words immediately, they are apt to fade from consciousness and are exceedingly difficult to recall.

[1] Italics mine, *cf*. p. 180, second para.

[2] William James, *Principles of Psychology*, Vol. I, p. 511. Reprinted by permission of the publishers, Messrs Macmillan & Co., Ltd.

A developing language extends the span of comprehension, i.e., *it favours growth in breadth of intellect.*

The span of attention is measured by the number of objects which can be perceived successfully at a single rapid glance or act of listening. This span is strictly limited, most people being unable to encompass more than six or seven different objects. In children, the span is usually less than this. If more objects are displayed than can be encompassed by the mental activity of the observer, the observation breaks down, as it were, and instead of the normal six or seven objects being recalled, only one or sometimes none at all can be thought of.

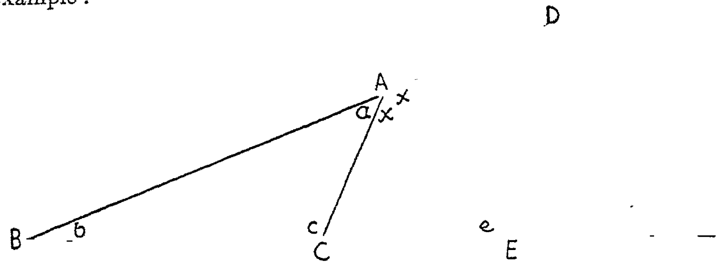
What is true of objects is much more true of ideas. It is difficult to think of more than one idea at a time. If we concentrate upon a second idea, the first quickly fades from explicit consciousness. If we must relate a number of disparate ideas, we must be able to hold them together mentally sufficiently long for the relations to emerge clearly. This can be done by speaking the corresponding words intently, or better still by writing the words down. Thus, since the written words remain permanently, each associated with the corresponding idea, the mental activity can be directed to the words as often as is necessary and the corresponding ideas related in a system. Again the words can be rearranged in various patterns making the rearrangement of the ideas, with the consequent emergence of new relations, more easy. Thus words favour breadth of comprehension.

Words offer a means of 'exploring' mentally a complicated situation more effectively.

Words can act as probes, as it were. Armed with a battery of appropriate words which have been associated with certain characters and relations *and memorized,* the learner can approach a new situation, apply the words to it in some definite order, and thus *direct his mental activity to corresponding features in the situation.* Observation of the presence or absence of specific characters and relations is thereby improved. This fact has been demonstrated experimentally by Fox (see p. 222).

Instead of words, conventional symbols may be used for the same purposes. This has been done most extensively in mathematics and those physical sciences capable of mathematical expression. The dis-

cussion in this section can be illustrated very clearly by a mathematical example :



ABC is a triangle of which the side BA is produced to D. AE bisects the angle CAD and cuts the side BC produced, at E. It is required to show that the angle AEB is equal to half the difference between two angles of the triangle ABC.

In this example we have a fairly complicated figure manifesting many possible relations, and a rather vague problem. We have therefore to explore the situation first, isolate a number of possible relations, think them over, arrange and rearrange them until we get a system which is relevant to this particular demonstration.

Suppose we represent each angle by a letter. Previous experience suggests that out of all the possible relations shown in the diagram, the solution will depend on the fact that the exterior angle of any triangle is always equal to the sum of the interior opposite angles. (Note the process of supplementation by memory.)

Now we can write down some relations, *e.g.*,

$$2x = b + c.$$
$$c = e + x.$$
$$x = \tfrac{1}{2}(b + c).$$

By combining these equalities and rearranging the terms we can arrive at the relation required, thus :

$$\begin{aligned} e &= c - x \\ &= c - \tfrac{1}{2}b - \tfrac{1}{2}c \\ &= \tfrac{1}{2}c - \tfrac{1}{2}b \\ &= \tfrac{1}{2}(c - b). \end{aligned}$$

I.e., angle AEB is equal to half the difference between angles ACB and ABC.

Finally, to test the value of the words and symbols in working out the demonstration, readers are invited to solve the problem *without using any words or symbols* either spoken or written.

Thus intellectual development goes on concurrently with the development of a conventional language. The language serves as a vehicle for the analysis and synthesis of experience, and at the

same time it fixes and preserves the gains of mental activity. Conversely, the developed language favours the active exploration of new situations thereby providing more fundaments out of which further systems of relations and an increasing vocabulary may be evolved.

The educational value of language is therefore immense, *always provided that the language develops along with the active analysis and synthesis of real experience.* If language is taught mechanically without its corresponding ideas its educational value is nil. The result is a fatuous verbalism which hinders rather than helps further intellectual development. (*Cf.* p. 155). Hence it is essential in teaching for intellectual development, to follow these rules:

(*a*) Appropriate words should be provided for every new character and relation which has been grasped explicitly by the pupils.

(*b*) The ideas and the associated words must be memorized together *so that the association becomes habitual.* Then the words can be used as carriers for the ideas.

(*c*) Constant careful training in the accurate use of words is indicated.

Clearness of expression is evidence of clear thought but also the effort to express thoughts clearly encourages the development of clear thinking. The two abilities are inter-related. Hence the value of calling attention to ambiguities of speech and giving practice in word discrimination.

In this connexion the learning of a second language is valuable *for those pupils who have sufficient intelligence to profit by it.* There are many ambiguities and inaccuracies in English which are not realized explicitly until a pupil begins to learn a second language with a different idiom. In colloquial English we say, "I am going away for a holiday next week." The absurdity of this common usage is not realized explicitly by the average pupil until he learns that the French always use the future tense of the verb to express the corresponding idea.

The effectiveness of the comparison and contrast of word-meaning and grammatical structure is likely to be the greater, the more the two languages differ in idiom. This is the real psychological and educational reason why Latin or Greek may be a better medium *for linguistic discipline* than a modern Western European language, for English pupils.

The arguments in this section dispose of the contention of some non-language specialists that the teaching of English is not their

concern in school. Actually, no subject can be taught effectively, even mathematics and science, unless careful attention is paid to the need for clarity of expression in both spoken and written speech. The fact is that every teacher is to some extent necessarily a teacher of language if he does his work efficiently. Contempt for grammar and accuracy of speech encourages the spread of 'journalese' in many schools, which is as offensive in its lack of style as it is ineffective for the purpose of expressing clear meaning. We may well pray to be delivered from the modern 'tabloid' newspaper-headline mode of speaking and writing, and the absence of clear thinking of which it is the outward manifestation.

Meaning of Concept

Books on the psychology of knowledge and theory of education frequently contain the term 'concept.' It is desirable therefore to know exactly what the term signifies.

The dictionary meaning of 'concept' is "an idea of a class of objects, a general notion." However, classes of objects, from a logical point of view, can only be established mentally by the abstraction of characters and relations. Any abstracted character or relation must of necessity be general, *e.g.*, white, red, square, a length of 12 inches, one pound weight, an angle of 90 degrees. Their generality is established by the fact that any such character or relation is necessarily constant and applies to any object or set of related objects which embody that character or relation.

Hence, using the analysis developed in the previous section, we may say that a concept is any character or relation which has been abstracted mentally.

Concepts may represent very different degrees of subtlety and complication.

Experimental Investigation of the Growth in Children of the Power to educe Relations

Some experimental evidence concerning the growth in children of the power to educe relations has been obtained by Line.[1] The evidence is not only valuable from a psychological point of view, but useful for practical teaching-purposes.

Line set out to find answers to the following questions: At

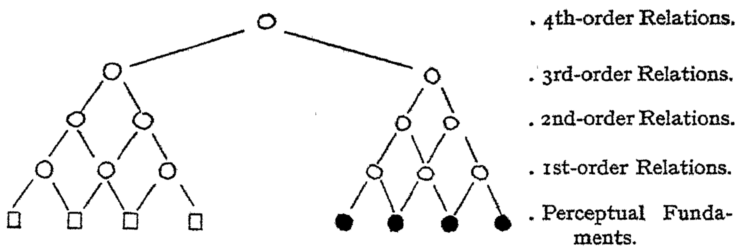
1 "Growth of Visual Perception in Children," *British Journal of Psychology*, Monogr. Supplement, 15, 1931.

what age does the power to educe relations emerge; what type of relations can children of a given age recognize; what connexion exists between power of educing relations in the visual test material employed in the investigation and intelligence (as measured by a standard mental test); is progress continuous or does it proceed by jumps?

The experiments included some 1500 children from two and a half to sixteen years of age. The tests were restricted to the eduction of relations of similarity and difference between colours, shapes, and lines.

The tests were so arranged that they included increasing orders of complication and difficulty. Some tests involved only *first-order* relations, *e.g.*, the relation 'same' or 'different' between two colours. Other tests involved *second-order* relations. Thus the child was presented with a card bearing two figures similar in shape and colour. He was next presented with a card bearing two figures similar in shape but different in colour. Now, the task is to compare the relation (similar) between the first pair, with the relation (different) between the second pair, and apprehend a *second-order* relation (different) between the two relations.

Relation-systems can be complicated to almost any degree. The process can be represented diagrammatically as follows: [1]



The most important findings in this investigation for our purposes were the following:

1. The scores in these visual tests showed a high degree of correlation with the scores made by the same children in a standardized verbal 'intelligence' test (Spearman's *Measure of Intelligence for Use in Schools*).

[1] In this diagram the open squares and black circles are intended to represent characters derived from observation of perceptual details. The open circles represent relations apprehended between corresponding characters or relations. It is possible to apprehend relations between relations, and relations between systems of relations, in increasing order of complexity.

This fact implies that the same aptitude (or aptitudes) were involved in both performances. At first sight it might be supposed that Line's test-material involved only visual perception of shapes and colours while the intelligence test involved knowledge of abstract word-meanings and ability to reason. Thus the two types of test were related to each other as perception is related to thinking (or reasoning), and there has been a strong tendency on the part of psychologists and teachers to believe that these two activities were quite distinct and separate. Line's investigation indicates that what we commonly call perceiving and thinking have very much in common.[1]

Incidentally, this result is significant for the study of bilingual problems since it indicates the possibility of estimating the actual mental development (or intelligence) of bilingual children by means of non-verbal tests. It is obvious that *verbal* intelligence tests are useless in bilingual work since they take for granted the very factor they are supposed to investigate.

2. The eduction of relations begins very early in life.

3. Improvement in power to educe relations with increasing age is revealed in two ways: by a rise in the order of the relations grasped correctly; and by an increase in the number of fundaments which can be comprehended (*i.e.*, held together mentally) within the same situation. This may be likened to an increase in depth or subtlety, and in breadth or complication.

Taking average ages, three-year-old children passed first-order tests successfully. Between three and five years the ability remained at about the first-order level, but improvement consisted in relating more fundaments together.

Second-order tests were passed completely at about five years, and the period five to eight years was occupied with another increase in breadth of comprehension.

Third-order tests were passed completely at eight to nine years, and fourth-order tests at about eleven to twelve years.

These averages give some indication about the ability which may be expected in the normal school pupil at the ages mentioned. The moral is, do not present multiple-order relations too early.[2]

4. Cognitive development obeys two rules which we have already noted about development in general, namely:

[1] In this connexion see the sections on observation, reasoning, factorial analysis of ability in Chapters VIII and IX below.

[2] Compare the springing-up and filling-out periods, p. 37.

(i) Eduction of relations between objects as wholes, occurs more easily and at an earlier age than eduction of relations between details within each object. Progress, that is, goes from broad to increasingly finer discrimination of details, an important factor in determining choice of subject-matter and materials for practical activity at different ages.

(ii) Eduction of relations takes place at different orders of subtlety at the same time, and improvement takes place at all levels simultaneously.

The following results abstracted from one of Line's tables illustrates this point.[1]

Years	6	9	12	15
1st-order tests . . .	5·0	7·6	8·1	9·5
2nd-order tests . . .	3·2	6·4	6·8	9·0
3rd-order tests . . .	2·3	4·8	5·2	6·8
4th-order tests . . .	1·3	2·3	4·0	5·4

The numbers in the above table represent *average* scores on tests of a given order, made by children at the ages indicated.[2] It will be seen that six-year-old children while most successful on first-order tests showed some degree of ability even on fourth-order tests. Also the improvement continues on all four levels simultaneously. That implies that there is *no sudden jump in ability* at any given age, and therefore it is not necessary for the child to become perfectly proficient at first-order relations before it can attempt to educe second-order relations. This point again is important in choice of materials for instruction and the organization of syllabuses.

In addition to the facts presented about the development of relation-eduction with increasing age, Line also showed two further facts of great educational importance.

(*a*) Separation, both in space and time, of the fundaments between which a relation is to be educed makes the realization of the relation much more difficult. Realization is easiest when the fundaments are presented in close proximity, and it may be prevented altogether if they are widely separated. This indicates another important principle in lesson-presentation and guidance.

[1] Work cited, Table A, Appendix II, p. 125.

[2] A score of 10 would represent complete success in any given test.

(*b*) There is a distinction between 'as' and 'that' cognition. In other words a person at any age can react to characters as related to each other without realizing explicitly *that* they are related. This point has already been mentioned in the discussion of implicit and explicit cognition.

NOTE ON THE CONDITIONS OF EFFECTIVE ATTENDING

Alert critical attending is necessary for analysis of experience and the eduction of relations.

The process of attending consists in making a complex set of adjustments which serve to produce the best conditions for the reception of certain sensory stimuli and to direct the mental activity towards certain specific impressions or ideas at the expense of others.

Books on educational psychology and teaching-method used to show elaborate classifications of 'attention' as though there were several different types. Actually there is only one process of attending, but this may be started, and maintained, in different ways:

Involuntary attending is caused by a sudden intense change in some sensory quality of the environment, *e.g.*, loud sound, flash of light, pain. In this case certain hungers for security and well-being are aroused and the person *cannot help but attend* until the situation becomes normal again.

Spontaneous attending is caused by the presence of an unsatisfied hunger. It is maintained until the hunger is satisfied. Involuntary attending is really a special case of spontaneous attending in which the process is maintained for a short period only.

Voluntary attending happens when the person *decides* to attend, and actively maintains the attitude of attending. This mode of attending is characteristic of a mental conflict during which there is a competition for the available mental activity. The direction of activity oscillates, being distracted between two or more objectives. In order to determine the conflict, motives derived from the hunger for self-enhancement are brought in to reinforce one side of the conflict at the expense of the other. This happens when the wavering or distracted person decides, "Now I must (or will) attend to this object instead of that."

In teaching-practice no difficulty arises during spontaneous attending. Then mental activity is continuously directed towards the satisfying objectives. This is the best condition for learning. However, it frequently happens that school-activities do not arouse spontaneous attending. Or, in other cases, distractions are inadvertently introduced into the situation either by changes within the attending person, or by events in the local environment. Since distraction due to conflict is not conducive to effective learning, it is desirable to note some of its causes in order to prevent it as far as possible.

SOURCES OF DISTRACTION AND COMPETITION FOR MENTAL ACTIVITY

1. Conflicting sense-impressions, particularly if intense and lasting. Refer to Fig. 13. If the mental activity is concentrated on the printed words, the figure underneath is not adequately perceived, and *vice versa*.

FIG. 13

2. Hungers and aversions in conflict.
Examples of this have already been noted. When any strong motive is active it determines what sensory impressions and ideas shall be favoured. Hence during a conflict of motive there will be a corresponding distraction as between two sets of impressions or ideas.

3. Any emotional disturbance interferes with alert steady attending. When one is angry or afraid it is difficult to attend to anything else but the source of anger or fear. If one tries to read, or work a

calculation, the process is disturbed by the intrusion of ideas and feelings associated with the emotion.

4. Perseveration.

This is the name given to the tendency for mental activity once it is started in some particular direction to persist by its own momentum, so to speak. Different individuals experience this tendency in widely different degrees, but most are familiar with the experience of a tune or refrain which keeps intruding into the 'focus of consciousness' and displacing ideas already there.

Some causes of distraction commonly found in class-teaching are:

1. Showing too many objects, or presenting too many ideas at the same time.

2. Presenting badly grouped sensory impressions or ideas, including the case in which the mental objects to be contemplated are separated too widely in space or time.

Examples :

Chaotic disarrangement of words and sketches on a blackboard.

Performing experiments while the demonstration table is littered with miscellaneous odds and ends of apparatus.

Having striking pictures or diagrams on the wall of the classroom facing the class during a lesson for which they are not appropriate.

Giving out several conflicting instructions. Presenting items of information too quickly and in bad order.

Some more subtle sources of distraction are:

1. Competition between the appearance of an object and its significance. This happens in reading words. If one attends closely to the appearance of the words one neglects their meaning and *vice versa*. (*Cf.* p. 141).

2. Competition of aims. This would occur if we told pupils to listen to the plot of a story and at the same time to pick out as many nouns as possible in the narrative.

3. Competition between a situation or object as a whole and the details which constitute it, *e.g.*, in a page of print, if we attempt to visualize it as a whole we neglect the individual words. The same thing holds good for pictures, maps, models, scientific apparatus. Occasionally some striking detail monopolizes the mental activity at the expense of other details and of the object as a whole. This is one frequent cause of distorted perception. (*Cf.* drawings on p. 178.)

In presenting complex objects for teaching-purposes, it is desirable to call attention first to the object as a whole, then direct the mental activity to the desired details, lastly *relate the clearly apprehended details to each other and to the whole.*

A special case of this type occurs when a striking illustration, joke, or story is more interesting than the lesson of which it is a part. If such an item is introduced in a lesson, care must be taken to allow the immediate interest to subside before proceeding further.

4. Competition between the process of attending itself, and the object of attending.

This frequently occurs in attending to obscure stimuli. We strain to attend and in doing so become preoccupied with the strain and fail to note the object itself.

This is one difficulty of voluntary attention. A bored student may try to drive himself to attend by repeating in inner speech, "I must attend to this." In consequence he attends to the process of attending and forgets for the time being what it is he is trying to concentrate upon.

In presentation, particularly to younger pupils, we should take pains to make all the stimuli clear so that no distraction is caused by the effort to attend.

OTHER CONDITIONS AFFECTING CLEAR ATTENDING

1. Facilitation due to familiarity and habit.

When any character or relation has been clearly apprehended it is easier to note the same item on a subsequent occasion. Hence, other things being equal, we tend to note familiar details and neglect the novel aspects of a situation, which may, of course, be the more valuable.

Also, we tend to note most readily the items for which names are known.

2. Fatigue and boredom prevent alert attending.

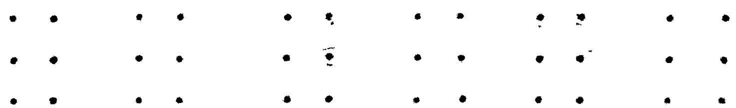
3. Oscillation.

It has been shown that intensity of mental activity and with it clearness of apprehension tends to rise and fall in a periodic rhythm. The intensity oscillates from a high to a low degree of intensity about an average level. This oscillation seems to be independent of fatigue.

4. Span of attention is limited.

We cannot attend to an indefinitely large number of items at the same time. If we attempt to do so the mental activity is dissipated and we do not attend clearly to any one of the items in question.

We can, however, attend to as many groups of objects as single items. This is illustrated by the following diagram:



Practice and familiarity increase the span to some extent. Fatigue and novelty decrease it. It is usually less in children than in adults.

The bearing of these facts upon lesson presentation is obvious.

CONCLUSION

All these cases emphasize one essential point, namely, *the process of attending is selective*. Concentrating mental activity on one item

in the field of awareness drains it away from other items which are for the time being ignored.

It follows therefore that *we cannot take any particular act of attention for granted*, especially in teaching younger pupils. It is always desirable to *direct specific attention to significant elements* in the lesson-material. This can be done by (*a*) giving clear instructions to attend to some specified detail, (*b*) asking questions and setting problems which cannot be answered until the appropriate observations have been accurately made, (*c*) pointing or using manipulative activity if the pupil's vocabulary is not adequate.

Further, *any presentation should be followed up* to test whether the necessary observations have been made accurately. (*Cf.* p. 325).

Finally, since pupils can attend effectively to only one thing at a time, make sure that all pupils are attending before giving instructions or proceeding with a lesson. If pupils are busy at work either in classroom or laboratory, and it is necessary to give some instruction, first call for silence, have apparatus and writing materials put down in a safe place, and *wait till all are ready to listen.* Then say what is necessary; make sure that it has been noted, allow a few seconds for it to 'sink in,' then let the work proceed.

When pupils move from room to room between lessons, a period of two or three minutes is necessary for settling down before beginning the lesson. In this case train pupils to take out just what books they require for the present lesson, put them conveniently on their desks, put away their bags, etc., and dispose themselves comfortably and quietly to listen. Make a point of not beginning until all are ready to listen. Students-in-training frequently spoil what would have been a good lesson by beginning before order has been established in the classroom.

Exercises

1. Examine critically the value of different types of questions and problems as tests of intelligence. Accepting the definition of intelligence as the ability to realize and use relevant characters and relations, state what must be the essential features of a good test of general intelligence. Compare various standard intelligence tests from this point of view.

What bearing has your exercise on the framing of oral and written questions for the purposes of (*a*) lesson-development, and (*b*) scholarship examinations?

2. By means of a vocabulary test explore the differences between a group of very bright pupils and a group of backward pupils of the same chronological age.

3. Illustrate the progressive analysis of a complex situation

into characters and higher-order relations by examining carefully and noting the stages by which you become acquainted with:

(*a*) a complicated building such as your college building.

(*b*) a strange town.

(*c*) a new class of pupils in school.

(*d*) a book dealing with some subject for study.

In the above, note carefully the function of intense and massive sensory impressions; the effect of interest and purpose (use); the effect of difficulty and mental arrest; the function of words, symbols, and maps; the function of memory.

What bearing has your exercise upon the introduction of a new topic or a new skilled method of working to a class of pupils?

4. Collect instances of correlate-eduction which are made by pupils during a science, mathematics, or history lesson.

5. Show in detail how the attempt to suggest a correct 'atmosphere' for the study of (*a*) pre-historic Britain; (*b*) an Anglo-Saxon village in the time of Alfred the Great; (*c*) Wat Tyler's Rebellion; (*d*) the Civil War in the reign of Charles I; requires the process of correlate-eduction in the pupils. How can this process be encouraged by the teacher? What part does the local environment play in the process? What precautions are necessary? What practical aids are likely to be useful (*e.g.*, pictures, models, visits to ruins, dramatization, etc.). What is the function of these practical aids?

6. State in detail the differences between a logical generalization and a summary.

7. Try to arrange a class of pupils in an order of merit according to some trait (*e.g.*, general intelligence; ability in history; cheerfulness of disposition; industry; trustworthiness) without using any words or symbols either spoken or written.

Why is it so much more difficult to perform the above exercise for the traits mentioned than it would be for height? Explain in terms of characters and relations.

Use the above exercise as an illustration of the function of words in mental activity.

8. Collect a number of drawings (*not* memory-drawings) of the same object (*e.g.*, a man, woman, dog, motor-car, tree, house) made by children from about three years to fourteen years of age. Compare the drawings from the point of view of nicety of analysis, grasp of relations, errors, and distortions.

What insight does the collection afford into the nature and

direction of intellectual development? Make a note of the types of details usually noted, and of those usually ignored. Apply your findings to the problem of directing attention.

9. Repeat Exercise 8, but with memory-drawings of familiar everyday objects by adults. Compare these with the occupations and interests of the adults. What details are noted, what omitted or distorted? How does your collection illustrate the law of least action in mental activity?

10. Collect instances, in your own experience and from the work of pupils, in which some character or relation has remained implicit and unnoted until pointed out specifically, or until it has emerged in the course of a discussion.

(Watch for the expression, "Oh! Of course! I can see it quite clearly now!)

11. Write down the steps by which a child passes from the experience of a collection of objects to logical classification and generalization.

Try to detect the steps as they happen in actual pupils whom you teach.

How far does the progress seem to develop spontaneously?

Books for Further Reference

BURT: *Mental and Scholastic Tests.*
,, *Distribution of Educational Abilities.*
BOARD OF EDUCATION: *Report on Psychological Tests of Educable Capacity.*
KNIGHT: *Intelligence and Intelligence Testing.*
SPEARMAN: *The Nature of Intelligence and Principles of Cognition.*
,, *Psychology down the Ages.* (Two volumes.)
THOMAS: *Ability and Knowledge.*
TERMAN: *The Intelligence of School Children.*
,, *Genetic Studies of Genius.*
CATTELL: *A Guide to Intelligence Testing.*
HAMLEY: *The Testing of Intelligence.*
MCDOUGALL: *Outline of Psychology.*
STOUT: *Analytic Psychology.*
WARD: *Psychological Principles.*
DEWEY: *How We Think.*
TRENCH: *The Study of Words.*
FOWLER: *Modern English Usage.*
JEPSON: *Clear Thinking.*
MCMUNN: *The Child's Path to Freedom.*
ROSS: *Groundwork of Educational Psychology.*

CHAPTER VIII

CONTINUOUS MENTAL ACTIVITY—THINKING AND OBSERVATION

So far we have discussed perceiving, attending, apprehending characters and relations, abstracting, correlate-eduction, and memorizing as if they were separate processes. Such treatment is a device necessary for exposition. In normal waking-life our mental activity flows in a continuous complex stream of which the more elementary processes just mentioned above are only aspects. Which aspect will be predominant at any moment will depend upon our environmental circumstances, needs, and interests.

There has been a tendency in the past to emphasize distinctions between mental and physical activity. This has been marked in the case of perception and conception. There is, however, no hard and fast distinction between the two. Perceiving is not exclusively a physical activity, nor is conceiving exclusively a mental activity ; neither is perceiving exclusively a childish activity and conceiving an adult activity. The two types of experience represent the extremes of a scale of activity, physical qualities predominating at one end and mental qualities at the other. Both occur at all ages. So soon as the young child realizes some simple outstanding character of an object or apprehends a simple first-order relation the conceiving activity has begun. These simple concepts form the groundwork upon which the abstract theoretical systems of adult knowledge will be built.

It is merely a convenient device to abstract thinking from perceiving. If we attempt to divorce the two in the practice of teaching, we are prone to encourage a one-sided development of the pupils. We tend either to restrict the training to first-hand experience, *i.e.*, practical activity with concrete things ; or to feed the pupil entirely upon words, *i.e.*, definitions, ready-made generalizations, and logical arguments divorced from the practical situations of which they are the logic. In the first case the pupil may be practically skilful in simple concrete problems but unable to think in general terms. In the second case, he will memorize words and formulæ without realizing their significance. Enrich-

ment of practical experience should go hand in hand with conceptual development.

With this proviso, we shall now consider the characteristics of four modes of thinking important in school-work:

Reproductive Imagination.
Fantasy (Day-dreaming or Reverie).
Constructive or Inventive Imagination.
Reasoning.

In all forms of thinking the items within the stream of thought cohere by virtue of some type of association of ideas. The different types of association serve to distinguish each mode from the others. These distinguishing characteristics of association will be indicated in what follows.

Reproductive Imagination

This is the process involved in the recovery of a series of past experiences, either (*a*) in the space-time sequence in which they were originally enjoyed, or (*b*) in some order which is conventionally correct.

The mode of association is mainly by sequence. Each item in the series is called up by its immediate predecessor, and it recalls the one next following.

An example of the first type is when we recount the details of a journey, enumerating the places we passed through, and the events which happened, in the space- and time-order in which they occurred.

Examples of the second type are the reproduction of tables of weights and measures; spellings of words; theorems in geometry, or pieces of poetry; drawing diagrams of mathematical figures, or scientific apparatus.

The reproduction is usually effected *in the first place* by means of some form of imagery. That is, we seem to see, hear, or feel something which represents the actual experience as we had it originally. If the original experience was very striking and exciting, after we have been through it once we can recover it in imagery, often very clearly, on a subsequent occasion. Even if the experiences are relatively mild, and free from emotional accompaniments, the subsequent imagery may be very distinct, approximating in some cases to hallucination.

Recently, studies have been made of what has been called *eidetic* imagery. The investigations have been concerned mainly with visual imagery in children. The subject of the experiment is seated at a table with his back to a window. A screen of dark grey paper is placed at a distance of half a yard from the eyes. Coloured papers, pictures of animals, houses, trees, or silhouettes rich in colour and

detail are exposed to the gaze of the child. In some experiments toys and other solid objects are shown. The objects are exposed for a short time, then removed, and the child asked to report what he can then 'see' upon the screen. Some children have been discovered who can report with great fidelity minute and even meaningless details. Allport states [1] that individuals capable of reproducing these eidetic images can report without effort the precise number of buttons on a pedestrian's pocket, the letters composing a word in a *foreign* language on a poster in the background, the length and direction of the lines of shading in a stretch of roadway, the number of whiskers on a cat's lip. The case of an Italian child has been reported who could, without special effort, reproduce Hebrew words, or symbols taken from the Phœnician alphabet. The presentation of a picture for thirty to sixty seconds may be sufficient for obtaining accurate eidetic images after some months or even a year.[2]

The phenomenon seems fairly common among children, but disappears with advancing age, probably owing to an increased tendency to think in words which represent *generalized experiences or classes*.

Obviously the possession of such clear imagery as has been reported in some of the experiments is an aid to reproduction. On the other hand, since the imagery is so distinct and concrete (*i.e.*, concerned with particular cases) *it may be a disadvantage* in that, if it persists, it may prevent the more rapid and effective thinking in words and general propositions which is so necessary in mathematical and scientific pursuits of all kinds.

Some kinds of experiences, usually second-hand experiences of words and symbols, need repeated reproduction before they can be retained accurately; nonsense syllables, strings of digits, spellings of words, for example. In this case the reproductive imagination shades off into a motor habit, and the imagery tends to disappear *so long as the habit is successful.*

For example, if I am asked to give the answer to 6×8 the words 'forty-eight' occur immediately, without the accompaniment of any kind of imagery that I can detect. Similarly, if asked to spell 'cat' I say 'c-a-t,' again without being able to detect any imagery. If, however, the test word is a 'teaser' like 'phthisical,' or 'psychiatrist,' I cannot depend upon habit. The letters have not been repeated sufficiently often in that order. In such a case I have first a feeling of hesitation and doubt, then visual and motor images begin to arise. I imagine what the word looks like, and what it feels like if written.

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[1] *British Journal of Psychology*, 1924, Vol. 15, pp. 99–120.

[2] Kluver, *Eidetic Imagery*, Handbook of Child Psychology, Chapter XVII, p. 699.

I also emphasize the words strongly in subvocal speech, and this appears to strengthen the visual images. If I get into difficulties I have to concentrate more intently upon the visual image. If this is not successful I usually write down a few possible alternatives and then select the one which looks most satisfactory.

Imagery seems to be very much of a personal idiosyncrasy. It differs in different individuals both in kind and degree of intensity.[1] There was a tendency at one time to suppose that children (and adults) could be divided into pure types, according to their dominant imagery, namely, a visual type, an auditory type, and a motor or kinæsthetic type. Careful investigation shows that examples of a pure type are seldom found. Most people possess and use images of several kinds. We may, and usually do, have a preferred kind of imagery, on which we depend most often for mental reproduction, but when this fails we fall back upon any other kind which will serve the purpose.[2]

Readers can get a rough insight into their own preferred imagery by attending carefully to the way in which they remember how to spell words, or reproduce figures, diagrams, or definitions of which they are not quite sure.

Another indication is given by the way in which one remembers a stage play, particularly an opera. People who are, on the whole, visualizers, will reproduce it mentally by imagining what it looked like. Images of colours, shapes, spatial arrangements of stage, furniture, scenery, the appearance of the characters in the play, will come to mind most readily, attended by kinæsthetic and auditory elements as subsidiaries. People who prefer auditory images will reproduce the sounds, noises, melodies most readily, with kinæsthetic and visual elements as subsidiaries.

The kind of imagery we use for mental reproduction is governed also by the way in which we have lived through the actual experiences. If our school-training was exclusively oral, we shall reproduce spellings and definitions by auditory-motor rather than visual images whatever may be the kind we prefer.

Since we shall require pupils to retain the significant items of

[1] See Galton, *Enquiries into Human Faculty*, Everyman Edition, p. 57 *ff.*

[2] For myself, I depend mainly upon a combination of visual and motor images, but in certain cases I can detect, quite distinctly, mental reproductions of sounds of letters and words, mechanical noises or melodies. However, I cannot, no matter how much I concentrate upon it, mentally reproduce (*i.e.*, imagine) a sound without making some movements of tongue, lips, and larynx which would produce an imitation of it.

experience presented to them in school, and be able to recall the corresponding ideas and images, we must take care in presentation to ensure that the experiences in question make as massive and vivid appeal as possible.

Generally speaking, visual impressions are most effective, and the majority of pupils possess visual imagery. Nevertheless, any group of pupils may contain individuals in whom visual imagery is relatively weak, and who rely more on sound and movement (kinæsthetic) impressions.

Also, co-ordinated impressions through several sense-organs at the same time reinforce one another.

Therefore, in presenting experiences for educative purposes, we should make an appeal to as many sense-organs as possible. It is desirable in teaching a new word for the teacher to pronounce it, write it on the blackboard, allow the pupils to pronounce it and write it for themselves. Thus eyes, ears, and muscles in motor speech and writing, all contribute their quota to the total impression.

Fantasy, Reverie, Dreaming

By fantasy we mean the kind of 'thinking' which occurs in dreaming, both while we are awake and asleep. In some ways this is the most interesting and practically important type of thinking, since it leads to the creation of original thought-patterns and therefore is an essential feature in discovery and invention.

The motive for fantasy is an unsatisfied hunger. The 'castles in Spain' which we construct in a day-dream are wish-fulfilments. They provide us with substitute-satisfaction for hungers which cannot be fully satisfied in the everyday world of affairs. Many fairy stories, romantic novels and plays with happy-for-ever-after endings, idealized situations in painting, are all the objectified manifestations of fantasy. The imagery is usually vivid and concrete, and the process strongly tinged with feeling-tone and emotion.

What makes fantasy so interesting and practically important is the *kind of association* characteristic of it. In a day-dream we get an inconsequential succession of images giving thought-patterns which are sometimes bizarre in the extreme. For a while we may review some past experience—a journey or a conversation. The images pass along in the space-time sequence in which we enjoyed the experiences. Then quite suddenly, and sometimes apparently

inexplicably, the sequence breaks and a new set of associations begins. A personal example will illustrate this peculiarity.

I read a poem by D. H. Lawrence which describes with amusing and malicious accuracy a ride on a decrepit old electric tramway somewhere in the English Midlands. The poem started a day-dream, and I passed in review the thrills and discomforts I actually experienced on one memorable ride on this very tramway. In the day-dream the noisy old tram lurches and bumps along till we reach the town of H——. Then without any apparent reason or warning, suddenly I imagine myself in the reading-room of the British Museum. The change is so abrupt and apparently nonsensical that I stop to examine it. What connexion has H—— with the British Museum reading-room? I think carefully about details of the reading-room and *after some time* find myself in imagination talking to a friend O—— whom I met there unexpectedly on my last visit. Now the puzzling hidden association emerges. O—— was a schoolmaster at H—— before he joined the army in 1914.

The psychological significance of these abrupt, puzzling breaks in the sequence of images lies in the fact that we are *not necessarily conscious of the association.* There is no immediate association by contiguity, succession, or similarity. The associations in question are analytical, that is, one detail in the first series of images is connected with a detail of the second series. In the example described above, by thinking round the images of the British Museum reading-room and analysing out various details connected with that situation, I was able *after some time* to discover the active significant association, although I was quite unable at first to account for the sudden transition.

This example was commonplace and yielded easily to analysis. Many of the obscure connexions in both dreams and day-dreams remain persistently hidden from consciousness, but are at the same time *active in determining the sequence of images* experienced by the dreamer.

The *theory* of psycho-analysis is an attempt to formulate a rational explanation of such unconscious association processes, and psycho-analytic *method* is a practical procedure used more or less systematically by medical psychologists for analysing out and making the hidden connexions explicitly conscious to the thinker.

These analytical associations are important in medical psychology, being causative factors in mental disease. If the connexions remain unconscious they are beyond voluntary recall, and therefore not controllable by the thinker. They are strong and persistent in many

cases, and may arouse frightful or shameful images which cause the patient much anxiety. The very fact that the associations recur and that the connecting links cannot be discovered or controlled may in itself be disconcerting and exasperating. Normal constructive thought-processes are disrupted, energy dissipated, and fatigue produced. In this way alone, by disrupting the normal mental organization they may produce a condition of mental ill-health. If the images recalled by the hidden connexions are frightful or shameful (as in some dreams) they arouse fear and disgust in addition to the exasperation due to the feeling of helplessness and mystery, and their disruptive influence upon mental organization is correspondingly stronger. In some mental diseases, the essential step in the cure of the patient is the analysis of the hidden connexions which cannot be recovered voluntarily. When the hidden connexions are made explicitly conscious, the patient can gather up the dissociated elements in his mental organization and bring the whole again under his voluntary control. The function of the psycho-analyst is to uncover the hidden connexions by the use of his 'method,' thus enabling the patient to reconstitute his disrupted personality.

The importance of fantasy for practical invention and theoretical speculation is due to this possibility of analysing experiences and images into elements which can then be recombined into thought-patterns never actually experienced. The synthesis may represent anything from a comic strip or a new form of gargoyle to an abstruse hypothesis in physics.

Fantasy may be both an advantage and a danger. It is an advantage in that *the imagery represents a mental trial-and-error experiment* which can be carried on without the necessity for overt action. When our desires are baffled by difficulties, we imagine our problems solved, and thereby devise ways and means of solving them. In the day-dream, events are represented as happening in the way we desire them to happen. We can compare our present condition with conditions in the past, and project ourselves into a possible future. The images in a day-dream are manageable in ways our actual experiences are not. We can exaggerate the value of some details, and ignore others. We can split up a total experience, fix upon certain details, and combine these with details from other experiences, and do all this without the expenditure of time and labour which would be necessary to perform the operations in our actual world.

Children continually perform these mental experiments. They imagine themselves as what they would like to be when they grow

up. Many small boys and girls dramatize their fantasies in play. They invent companions, play at being parents, soldiers, sailors, drivers of trams and trains. This may seem to the adult a rather foolish procedure. Actually it enables the child to experiment in personalities and in various ways of living; to put himself into the position of other people, and thus widen his contacts with life. In so far as the child tends to objectify his fantasies in play he is widening his experience and acquiring new knowledge. Incidentally, he learns in the most effective way to distinguish what is actual, and possible, from what is merely a vagary of the imagination. Thus fantasy is an indispensable instrument of individual and social progress. If we imagined no ambition as individuals, and did not dream of the possibility of standards of living and a level of social happiness at present beyond our realization, we should be content to remain at a crude stage of living. The construction of an ideal in fantasy in response to a feeling of need is often a necessary preliminary to the realization of an advance in actual life.

Fantasy becomes a danger, only when the imaginary world is accepted as a satisfactory substitute for reality. If a person refuses to face his difficulties and retires within himself to seek substitute satisfaction in a day-dream, then the latter acts as an opiate and stifles effort. Such an individual loses his grip on life, and becomes socially and intellectually ineffective.

The motive operative in fantasy is, as we have seen, some unsatisfied hunger. The hunger may be due to some specific lack which is clearly recognized by the person in question—lack of food, water, freedom of movement. On the other hand, a fruitful source of fantasy in the growing individual may be the pressure of a newly maturing function for expression, before the knowledge and skill necessary for adequate expression have been gained. Day-dreaming may be a kind of mental play and the activity of dreaming itself a source of satisfaction to the growing organism, just as the physical play of a child is a source of satisfaction for the needs of his maturing bodily organs. Thus, the day-dream may reveal, both to the pupil and to an observant teacher, a natural bent of the individual and indicate the lines along which his future development may best be planned.

This possibility makes it undesirable to over-organize a child's activities. Some time ought to be allowed, and opportunity provided for the pupil to browse unfettered by examination requirements or vocational demands.

Constructive or Inventive Imagination

This is the mode of thinking characteristic of invention and problem-solving.

In the day-dream no objective conditions are imposed upon the thinker. His aim is some kind of personal substitute-satisfaction in which objective demands of time and space are not important. In fact, fantasy is a device for circumventing the awkward conditions which the physical environment imposes upon the dreamer.

On the other hand, in constructive imagination the products of the thought-process must accord with certain objective conditions which are implied by the nature of the problem to be solved. Hence this mode of thinking must include a critical attitude and some form of logical demonstration, *i.e.*, reasoning.

Any simple problem-solving situation will illustrate the way in which reproductive imagination, fantasy, and logical demonstration are incorporated in constructive imagination. In a crossword puzzle one clue given was, "Made in more senses than one by successful carpet-manufacturers." There was no indication of the first letter, but the word must have four letters.

Here the imposed conditions are clear—the word must have four letters and represent two meanings both connected with carpets.

We begin to *recall* what we know about carpets. Nothing seems to fit. We find ourselves *thinking rather aimlessly* about carpets; rooms in which we have seen or walked on carpets; rich, gorgeous carpets; walking on velvet. Then, quite suddenly, the word 'pile' pops up, as it were, from nowhere. This word has four letters. It is made by successful carpet-manufacturers. It also fits the second meaning indicated in the clue, since the successful manufacturer makes a 'pile' of money.

We then *check the cross references* (demonstration). These indicate that the second letter must be 'i' and the fourth 'e.' The problem is now completely solved.

Mechanical invention and scientific investigation are not entirely

precise and calculated processes. The element of fantasy is essential.[1]

It is said that the 'key idea' of a mechanical sewing-machine was revealed in a dream. All the sewing-needles known hitherto had had the eye at the end opposite to the point. The inventors tried for a long time to make a machine which would reverse the needle after passing it through the material to be sewn, but no practicable method of doing this could be found. So long as the eye of the needle was kept at the end opposite to the point, a workable sewing-machine was mechanically impossible. When at the stage of despair, one inventor dreamed that he was tied to a stake, about to be executed by a band of savages. The executioner stepped forward holding a spear in which there was a hole *near the point*. This provided the missing clue. Needles were manufactured with the eye near the point and the sewing-machine became an accomplished fact.

Progress in scientific theory and practice depends very much upon imaginative constructions of the possible or probable nature of things. Hypotheses are essentially fictions arrived at through the operation of fantasy, sometimes years before they can be verified by experimental test. One of the most striking instances of the 'fantastic' origin of a hypothesis was the suggestion of the ring-formula for benzene. Chemical analysis had established the fact that the benzene molecule contained six carbon atoms and six hydrogen atoms, but chemists could not conceive how these atoms could possibly be arranged in space. They were baffled, in the same way as the inventors of the sewing-machine were baffled, because they tried to solve their difficulty by the use of familiar knowledge, whereas an original construction was necessary. Up to that period, chemists had thought of the atoms in a molecule of an organic substance as if they were arranged in a line, something like an open string of beads. Kekulé, the inventor of the new hypothesis, thus describes how it occurred to him:

> I was sitting, writing at my text-book; but the work did not progress; my thoughts were elsewhere. I turned my chair to the fire and dozed. Again the atoms were gambolling before my eyes. This time the smaller groups kept modestly in the background. My mental eye, rendered more acute by repeated visions of the kind, could now distinguish larger structures of manifold conformations; long rows all turning and twisting, in snake-like motion. But look! What was that? One of the snakes had seized hold of its own tail and the form whirled

[1] See Montmasson, *Invention and the Unconscious.*

mockingly before my eyes. As if by a flash of lightning I awoke; and this time also I spent the rest of the night in working out the consequences of the hypothesis.[1]

That dream led to the foundation of the modern theory of benzene and its derivatives, which has played so important a part in many branches of industry.

One gets a false picture of scientific thinking if it is represented as consisting exclusively of observation and experiments with real apparatus. The function of observation and experiment is, first, to reveal difficulties which prevent us from realizing desires; second, to provide us with accurate experience and relations relevant to the problem; third, to *test* the fitness of the guesses which are produced by constructive imagination. In between gathering the knowledge about the problem and testing a possible solution, the solution itself must be formulated in a period of brooding reflection. If the scientific worker has not been gifted with an aptitude for this imaginative phase he remains what T. H. Huxley called, rather contemptuously, a hodman of science. He laboriously hews out and collects facts, but can do nothing more with them.

The 'mechanism' of constructive imagination seems to be correlate-eduction. Consider the case of the benzene formula. Chemical analysis proved that a benzene molecule contained six carbon atoms and six hydrogen atoms. These were the theoretical fundaments which had to be related into a system. The chemists also knew the kind of chemical relation which could exist between carbon and hydrogen atoms. In all other carbon-hydrogen compounds known at that time each carbon atom was joined chemically to other carbon atoms and one or more hydrogen atoms, *e.g.*,

$$
\begin{array}{ccccccccc}
 & & H & & H & & H & & H & \\
 & & | & & | & & | & & | & \\
H & — & C & — & C & — & C & — & C & — & H \\
 & & | & & | & & | & & | & \\
 & & H & & H & & H & & H &
\end{array}
$$

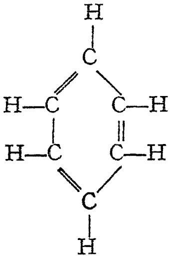
Each carbon atom thus required four chemical 'bonds' and each hydrogen atom only one. Hence the relation between the atoms was indicated. The problem was, given six carbon atoms and only six hydrogen atoms and the normal chemical relations between them, to educe a theoretically correct correlate.

The difficulty which prevented the eduction of the appropriate correlate was caused by the influence of past experience.

Incorrect correlates in the shape of chain formulæ (as shown above)

[1] Reprinted from the article on "Chemistry," *Encyclopædia Britannica*, Vol. V, p. 372, by permission of the publishers.

obtruded themselves by the process of reproduction, thus obscuring the development of a better alternative. The correct correlate which satisfied the system of chemical relations was found to be:



in which some of the carbon atoms were joined together by a 'double bond.' This was the correlate suggested to Kekulé in his 'day-dream' by the analogy of a snake thrusting its tail into its mouth. When tested by further experiment the correlate was found to fit all the facts of the case then known.

Reasoning

Reasoning is the mental process used in argument, demonstration, or proof. J. S. Mill defined it in the most extensive meaning of the term as "inferring a proposition from a previous proposition or propositions; giving credence to it or claiming credence for it as a conclusion from something else." [1]

The formal reasoning described thus in the standard treatises on logic, and set out in those rather forbidding logical formulæ or syllogisms with which such books are so liberally decorated, seldom happens in everyday life. People, even young children, reason *without realizing explicitly that they are doing so.*

The dog which goes to the door on seeing his master put on a coat and hat performs a simple act of reasoning. So does the small child who on hearing a familiar step outside looks expectantly at the door, waiting to greet the person whose appearance he anticipates.

At a somewhat higher level of reasoning we find the thought-process of a person who digs up a piece of hard yellow substance and says, "This is gold." The same process appears at a still higher level of abstraction in such a case as the following. A physicist sends minute rays of light through two narrow slits placed very close together. These two rays fall upon a screen and the observer sees, not a continuous band of light, but alternate

[1] *System of Logic,* Book II, Chapter I.

light and dark bands. He then concludes that light must in some way resemble waves.

In all the above cases some experience is presented to the observer, and on the ground of this experience he bases a belief (conclusion). However, the antecedents need not be first-hand experiences. Facts or beliefs may be asserted in the form of verbal propositions from which conclusions can be drawn, *e.g.*, a person says, " I am fifty years old." If the year in question were 1900 then we should conclude that he must have been born in 1850.

The essential process in reasoning is *inferring*. In this process we pass mentally from the apprehension of something given—a datum—to the apprehension of something related in some way to the datum.[1]

What is the nature of this relation of inference ?

In the case of the child mentioned above, certain experiences have been followed by others so frequently as to become customary—a characteristic step is usually followed by the appearance of father or mother at the door. By virtue of the power of comprehension these happenings can be held together mentally in a simple system—sound-of-step-followed-by-appearance-at-door.

On a subsequent occasion, sounds of steps are perceived. Together with this fundament comes awareness of a relation supplied by memory, namely, " similar to the sounds usually followed by the appearance of father at that door." This enables the child to educe the correlate, namely, the appearance of father. Thus reasoning depends on the three noegenetic principles supplemented by memorization.

It is scarcely necessary to say that the child need not and does not repeat this explicit form of words. Neither does an adult *in familiar circumstances.* The whole process from experiencing the fundament, through reaction to the relation, up to the behaviour appropriate to the anticipation of the correlate is fused into one complex experience in which the various aspects are implicit. After repeated experiences of the same kind the process becomes a perceptual habit which does not require any verbalization.

Verbalization begins when the child is asked to say why he behaves in that way. Later, the reasoning-process becomes explicitly realized and verbalized *when a difficulty which does not yield to an habitual solution is critically argued out.* In the lives of many people in well-ordered circumstances with no theoretical

[1] See Stebbing, *A Modern Introduction to Logic*, p. 210.

interests, this explicit reasoning-process happens but seldom. Here we meet another instance of the law of least action.

VALID REASONING

It is obvious that inferences are not always correct. The familiar step is not always followed by the expected appearance. Similarly, the person who says, "This stuff is gold," may be quite wrong. On the other hand, *some inferences are invariably and necessarily correct and the anticipated conclusions always follow.* Inferences based upon these *necessary* relations are called *implications.* Valid reasoning must employ the relations of implication between antecedents and consequents.

Relations of implication are provided by exact experiment, logical classification, and definition. For example, chemical analysis has revealed that different kinds of material have constant characteristic attributes. One particular kind of yellow substance always has a specific gravity of 19·2. It is very malleable and can be hammered into sheets of incredible thinness. It exhibits certain characteristic chemical properties. Furthermore, in this one kind of substance *all* of a certain group of characters are found by repeated experiences to go together. The characters have to the substance the relations of attribution and constitution. This being so, we can define this unique constant system of characters and relations and represent it by a name—'gold.'

Now, the statement (proposition), "This is gold," *implies* the presence of any or all of the characteristic attributes of gold. Therefore we can say, "If this is gold, then its specific gravity will be 19·2." Conversely, we can say with perfect assurance, "If the specific gravity of this yellow substance is *not* 19·2, then it is not gold." This latter aspect of the reasoning process indicates how it can be used for the purposes of testing, demonstrating, and proving.

In certain cases we do not discover fundamental characters and relations by experiment, but we *agree upon a convention.* Thus we agree to call any group like this ● ● 'two' and any group like this ● ● ● ● 'four.' We then agree that 'plus' shall stand for a specified relation of conjunction. We further agree that any

● ●
group of the type ● ● ● ● ● ● or ● ● shall be called 'six.' Then
● ●

when these conventional definitions have been agreed upon by

everybody concerned, we can assert with perfect assurance that "Two plus four equals six." This is bound to be correct, since we have made it so by agreement.

It is worth noting that these propositions which depend on arbitrary definitions *cannot be proved*. They are merely accepted. It is easy to see that by adopting some other definitions of 'two,' 'four,' and 'plus' we might just as easily arrive at the convention, "Two plus four equals twelve."

Thus we find that valid reasoning depends upon:

(*a*) The apprehension of correct facts by the analysis of experience.

(*b*) Connecting these correct facts by means of relations which are found in experience, or made by convention, to be invariably the same, *i.e.*, universally true.

Hence it is clear that reasoning may be *invalid* or *fallacious* in two ways:

(*a*) The facts of the case have not been correctly apprehended.

(*b*) The relations used are not implications, *i.e.*, they are not universal in nature, or agreed upon by convention.

Errors in reasoning due to the first cause are called *material* fallacies; errors due to the second cause *formal* fallacies. Both sources of error should be searched for in examining a logical (or illogical) argument.

It follows from this that even a good logician may reason accurately in form but arrive at quite wrong conclusions for practice if he is not familiar with the material facts of the case. Hence the danger of getting a lawyer to advise you about medicine, and a doctor to advise you about law.[1]

LOGIC

Formal logic is very much of a mystery to many people. Actually it is merely the accurate study of the characters of and relations between all the possible kinds and combinations of propositions which will give valid conclusions. Just as the chemist studies the characters and chemical relations of elementary substances, and the biologist studies the characters and relations of different types of plants and animals, so the professional logician studies the characters and relations of elementary[2] propositions,

[1] This principle is recognized in every calling but teaching, and in that case everybody seems to know more about education than the teachers!

[2] 'Elementary' means here, not 'easy to understand' but 'logically simple,' *i.e.*, not capable of any further sub-division (*cf.* chemical elements).

classifies them, and thereby organizes the practice of reasoning into a science. By reducing all forms of valid reasoning to a few comprehensive formulæ, the professional logician can, on applying his formulæ, quickly detect fallacies in complicated arguments.

It is not necessary to have studied the principles of logic in order to be able to reason. If that were so there would be even fewer logical arguments in speeches and newspapers than there are now. However, if we wish to teach pupils how to reason, it is necessary to make them *explicitly aware* of the commoner forms of good and bad reasoning. This is not likely to happen unless the teachers themselves are *explicitly aware* of the forms of good and bad reasoning, and can use them deliberately. Hence, some knowledge of the elements of logic is essential for really efficient teaching, particularly at the more advanced levels of instruction.

THE FUNCTION OF REASONING

Many people believe that reasoning is a method of discovery. This is quite false. Discoveries and inventions are made by careful examination of first-hand experience followed by contemplation of the significance of the facts disclosed. The real function of reasoning is that of testing, demonstrating, or proving. This is evident if we consider the mental processes involved in mathematical or scientific demonstration. It is also revealed in simple planning. In planning we are presented with certain conditions which must be obeyed, and we have to find a method of procedure which will be practically sound. The procedure itself is imagined. Then it has to be tested to find if it is likely to work.

Bad planners just try to put into practice the first plan which occurs to them. This is usually a wasteful process.

For example, it is said that on one occasion a heavy gun was sent by ship to a distant port. On arrival it was found that no crane sufficiently powerful to lift the gun out of the ship was available. Thereupon the ship returned with the gun to procure a crane. The crane was packed underneath the gun and away went the ship a second time. Arriving at the port of destination, it was impossible to get the crane out because the gun was on top of it. They had to bring both back again to have them repacked.

To prevent a fiasco such as this it would be necessary to work out a plan beforehand, or, in other words, *make a mental experiment.* This involves first selecting certain facts, then stating corresponding implications. These implications indicate correlative facts which

can then be tested either by seeking already existing knowledge or by making a test-experiment.

Thus, in our example, if the gun weighed 50 tons (fact), this implies that there must be a crane capable of lifting at least 50 tons at the port of destination. Is there such a crane available? This can be tested by sending a telegram, or by looking up the detail in an authoritative book of reference.

'METHODS' OF REASONING: INDUCTION AND DEDUCTION

It is commonly believed that there are two general methods of reasoning—induction and deduction. Induction is said to be the method by which we pass, mentally, from the examination of particular cases to the assertion of a generalization about them. Conversely, in deduction we are said to pass, mentally, from a universal proposition to an assertion about a particular case.

Further inspection suggests, however, that induction in this significance is rather a case of classification than of reasoning, and deduction the enlargement of a class by the addition to it of another particular instance.

In teaching children the elements of parsing we might call their attention to a number of sentences like the following:

The boy is *near* the fire.
The book is *on* the table.
John stands *beside* Tom.
The dog sat *under* the table.
He jumped *over* the brook.
Etc., etc.

Inspection of the words in italics shows that they all perform a similar function, namely, they indicate a relation between the things named by two other words, either nouns or pronouns, in the sentence. We give the name 'preposition' to this class of words. We arrive thus at a generalization by induction.

Suppose now we meet another word not previously known, such as 'through,' in the sentence "The brick fell *through* the roof." Inspection shows that 'through' indicates a relation between brick and roof. We conclude that it is a preposition.

Thus we use the previously established generalization to classify a new particular case. Reasoning is used in this classification process. Fully expanded, the argument can be expressed in syllogistic form:

All words indicating a relation between things named by other words in a sentence, are prepositions.

This word 'through' indicates a relation between things named by other words in a sentence.
Therefore 'through' is a preposition.

Deduction, strictly speaking, is a process in which we accept certain propositions (which may be statements of general principles, definitions, or even assertions about particular cases) as data and then work out the implications which follow from these data.

Mathematical reasoning is almost entirely a deductive process of the type just described. Consider the following. In going home I can travel by tram to the terminus then walk by a direct road $2\frac{1}{4}$ miles. From the terminus, however, I may choose an indirect route which means that I must wait 16 minutes for a second tram, travel by it for 20 minutes, and then walk half a mile. I get home at the same time by either method. At what speed do I walk?

We examine the data presented and work out certain relations implied by them. Thus, the time taken to walk $2\frac{1}{4}$ miles must be equal to 16 minutes, plus 20 minutes, plus the time taken to walk half a mile. But the time taken to walk the half mile is assumed to be the same in each case. Therefore it is *implied* that the walker can cover $1\frac{3}{4}$ miles in 36 minutes. This deduction enables the speed of the walker to be calculated.

The method of induction, obviously, can never lead to absolute certainty, except in rare cases when it is possible to examine *all* the particular instances available and we know for certain that no other instances exist, or will be discovered in the future. Usually, induction gives only a measure of probability.

SCIENTIFIC REASONING. THE METHOD OF EXPERIMENTAL INVESTIGATION

It was supposed, largely through the erroneous opinions of Sir Francis Bacon,[1] that physical science was exclusively founded upon induction. For the reasons just stated in the previous paragraph, many logicians have denied that experimental science has any logical value. However, while the professional logicians have been gnashing their teeth, so to speak, the experimental scientists have gone blissfully onward from one spectacular success to another. This raises a question about the real nature of scientific thinking, and since science is commonly recommended in schools and colleges because it is supposed to train the ability to reason, it is desirable to realize explicitly the thinking-processes involved.

[1] See his *Novum Organum*.

A clear understanding of scientific thinking is an essential preliminary to teaching science effectively.

A very clear example of the investigatory method used in scientific research is provided by the work of Lavoisier, a celebrated French chemist, on the nature of combustion.

It was known that a number of substances when burned or heated in air increased in weight. The problem was to discover exactly what caused the increase.

Before any actual experiments were carried out for this purpose, Lavoisier imagined certain alternative possibilities which he stated in the form of *hypotheses*, namely :

(i) Matter from the flame and fire penetrated the pores of the containing vessel and entered the substance burned.[1]

(ii) Some portion of the surrounding air joined with the substance burned.

Now the problem was to decide which of these alternative hypotheses seemed the more correct. To do this Lavoisier stated the implications of each hypothesis in such a form as could be tested by experiment. Thus :

(i) If the increase were due to fire-matter, then if a known weight of substance were heated in a hermetically sealed vessel, the total weight of substance plus containing vessel would increase during the experiment.

(ii) If increase were due to air joining with the substance burned, then the total weight of the apparatus would remain constant, but the increase of weight of the substance would be equal to the decrease in weight of the air contained within the vessel.

Both these implications could be tested by experiment. The weights contradicted the first hypothesis and confirmed the second.

This investigation illustrates the course of all scientific demonstration. In the first place a practical or theoretical difficulty is presented. To begin with, *the facts of the case are confirmed.* This is an essential preliminary, since if the facts have been wrongly observed and asserted there may be no problem to solve. Next, by reflection upon the facts as confirmed certain possible solutions or explanations are constructed imaginatively. These are the hypotheses. Thirdly, each several hypothesis is considered and an implication which follows from it is asserted in the form : If hypothesis x is true then y is implied. The implication y is then tested by reference to facts already ascertained, or by experimental investigation. If y is found to be demonstrated then the hypothesis is accepted for the time being as correct. If not, it is rejected and a further hypothesis framed and tested.

[1] The work was performed between 1772 and 1774, at which period such a notion seemed quite reasonable.

Hypotheses are conjectured by fantasy in constructive imagination. The scientist endeavours to think himself into the 'nature' of the universe of which he can actually perceive only the outward signs, the events as they happen. He expresses this imaginative world in terms of tentative guesses or hypotheses. So far there is no difference in form between scientific and primitive thinking. The primitive man's gods serve exactly the same purpose as the scientist's electrons and forces. They are *possible* explanations of the actual events observed. The primitive man, however, accepts his hypotheses because they are personally satisfactory to himself. His hypotheses remain dreams. The scientific thinker goes on to *test* his hypotheses. This is the phase in which reasoning, properly so-called, enters.

REASONING BY ANALOGY

In practical life, and quite often in theoretical studies, reasoning is based on analogies. We argue that since x resembles y, therefore it must be y.[1]

Educational theory contains quite a number of examples, such as the recapitulation theory, culture-epoch theory, idea-forces acting as motives.

Primitive races and children generally are particularly prone to this kind of reasoning.

Most scientific hypotheses involve analogies. The falling apple is said to have suggested to Newton the notion that the moon also was falling towards the earth and this led to the formulation of the general theory of gravitation. Students of physics cannot fail to note the similarity between the structure of the solar system and modern models of the structure of the atom (planetary electrons revolving round a central nucleus).

If the similarities are correctly observed, and, in particular, if the analogies selected are *significant*, then reasoning by analogy may be a powerful instrument for research. However, these two criteria are difficult to apply and all arguments based on analogies need careful, critical scrutiny.

DEVELOPMENT OF REASONING-ABILITY IN CHILDREN

At what age do children begin to reason? The answer to this question depends on how we define reasoning. If we confine it strictly to the explicit use of implications in formal arguments

[1] *E.g.*, this stuff looks like gold. Therefore it must be gold.

then it is likely that a child does not realize *full* reasoning-powers until the period of adolescence. This was the type of reasoning assumed by the 'faculty' theorists when they denied that the reasoning-'faculty' ripened before puberty. If we consider the reasoning-process from a *psychological* point of view, then it may include any kind of inference. There is no doubt that children begin to make perceptual inferences at a very early age. They begin to pass mentally from the apprehension of a given event to the expectation of some consequence, not immediately perceived, which is likely to follow the first event. Evidence has been presented above [1] to show that children can educe relations even between relations themselves (*e.g.*, likeness and difference) at an early age, and act correctly upon their judgments. Further, Burt has found, as a result of an extensive application of standardized reasoning-tests, that the commoner simpler relations of space, time, number, quantity, similarity, difference, and the like, can all be grasped *before the age of seven, if only the material presented to the child is sufficiently simple, familiar, and adapted to his limited knowledge and powers of comprehension.* The young child's inability to reason is caused, not so much by an inability to apprehend logical connexions, as by an inability to *comprehend* (*i.e.*, hold together mentally in a single system) many different relations presenting *a high degree of complexity.*[2] Burt considers that all the elementary mechanisms essential for formal reasoning are present before the normal child leaves the infant department, that is, before the age of seven or eight years. Even logical criticism and the detection of absurdities is within the powers of normal children of eight years old if the instances are sufficiently glaring, and if the pupils have had some practice and understand what they are required to do.[3]

It appears that the growth of reasoning-ability follows a course similar to that already noted several times in connexion with the growth of other physical and mental functions. Growth begins in embryo at an early age. There are no sudden changes, and no gaps, in the development. The advance proceeds from coarsely defined activity through continuously increasing definition and specialization to full maturity.

[1] From Line's *Investigation on the Eduction of Relations*, p. 190.

[2] *Cf.* p. 190, para. 3.

[3] See Burt, Appendix III, *Report of Consultative Committee on the Primary School*, p. 265 *ff*.

Hence quite young pupils, particularly if intelligent, may be given exercises requiring some reasoning, provided that the terms are familiar and the situations represented are not too complex and abstract.

STEPS IN THE DEVELOPMENT OF REASONING-ABILITY IN CHILDREN

It is convenient to summarize the levels of development in reasoning. They seem to be:

(*a*) An event x is experienced as related to an event y. The situation, 'x followed by, or related to, y,' is repeatedly noted.

(*b*) x is presented, together with the belief 'same as before.' Thereupon y is expected and looked for.

(*c*) The process represented in (*b*) is verbalized and carried on mentally. This can happen only after the child is capable of some degree of abstraction.

(*d*) The terms related and the relations involved are analysed into finer characterization, and more subtle relations.

(*e*) Experience shows that some inferences are false. This difficulty calls attention to the reasoning-process itself which thereby becomes explicitly conscious.

(*f*) The nature of reasoning is investigated systematically and the various modes of valid reasoning reduced to formulæ and classified.

In the majority of pupils the development stops at level (*d*). Only after specific training in logical reasoning at the adolescent period does the development advance to level (*f*).

OBSERVATION

Of the powers which the lay public demand that the teacher shall cultivate in the pupils, next in importance after intelligence comes observation.

Observation is usually treated together with sense-perception and sense-training as though it were merely a function of perception. Actually observation depends as much (probably more) upon imagination and reasoning as upon sensory discrimination. Most readers will have heard of Sherlock Holmes's famous phrase, "Watson, you see; I observe."

We can infer the conditions of effective observation from the theoretical principles already discussed. They are as follows:

Acuity of sense-organs

This trait permits of fine sensory discrimination so that more precise analysis of characters of objects is possible. It is unlikely that a physician can become a first-rate heart-specialist unless he can hear well enough to distinguish fine differences in heart-murmurs.

However, good sensory acuity is not sufficient for good observation. As Holmes implied, there is more in observing than mere seeing. In any given situation, other things being equal, superior ability in observation will depend upon the following *psychological* conditions:

Familiarity with the situation observed

Frequent contact with the same situation produces facilitation and makes the discrimination of characters and relations more easy and rapid.

Knowledge about the situation observed

The more characters and relations already known and memorized, the more significant correlates is the observer likely to educe mentally and then search for in the actual situation. The importance of such knowledge is demonstrated every time an intelligent expert is compared with an equally intelligent novice. The owner of a car may have seen his engine many more times than the expert motor-mechanic, but he usually observes a good deal less about it when it goes wrong.

One very important feature of the knowledge about a situation is the possession of a battery of names. As we have seen, the names assist the systematic exploration of the situation, and items which would otherwise remain implicit and unnoted emerge into explicit clearness.

Interest in the situation and alert attending

Explicit attending and directing mental activity are essential in observation. The interest will depend upon the observer's need—practical or theoretical. In the absence of interest, even familiarity with and knowledge about the situation will not guarantee good observation, since the person concerned *will not be seeking for anything*. Therefore he will not attend with any concentration to the details. This is another instance of the law of least action. We never observe what has no interest for us. People do not

count the number of steps in the stairs up and down which they may have gone thousands of times. Neither do they count the eyelets in their shoes nor the buttons on their coats. Usually they have no need of this information.

Thus interest in, familiarity with, and knowledge about the situation are essential for effective observation. The blind man's superior observation of sound and touch details is due to interest in them and concentrated attending. Having lost his eyesight, he *needs* sound and touch impressions for his personal safety and as a means of gaining further knowledge. This superiority of the blind person is not in sensory acuity but in nicety of interpretation.

These conditions are significant for teaching-practice: To foster good observation we must

Keep the pupil in good health, take care of his sense-organs, and avoid fatigue.

Provide a rich and varied first-hand knowledge of the environment together with an accurate dictionary of names.

Stimulate interest in the situation—*make the observations worth while to the pupils.*

Direct alert attention to significant items in the situations observed, and train the pupils in *systematic ways of exploring* the situations.

The second and fourth of these conditions are emphasized by an experimental investigation undertaken by Fox.[1]

A number of university graduates were shown lantern slides depicting suits of armour and instructed to write down every item they could observe. The results were marked and the group divided into two sets of equal average ability as shown by this first test.

One set, N (=not lectured), was dismissed. The other set, L (=lectured), had a lecture on the structure of a typical suit of armour, the various parts being pointed out and the corresponding technical terms written on a blackboard. The students made notes and sketches, and were allowed a week in which to memorize the details.

At the end of the week both sets were shown another lantern slide of a suit of armour and again they all wrote down as many items as they could observe.

The lectured group showed an improvement over the unlectured group by some 57 per cent.

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[1] "A Study in Preperception," *British Journal of Psychology*, Vol. XV, Part I. See also Fox, *Educational Psychology*, Chapter III. Note the connexion of this investigation with the exploratory function of language.

In interpreting the results, Fox suggests that as a result of the preperceptual system organized by the lecture- and the learning-period, the trained group was capable of 57 per cent. more separate, definite acts of attention. By having a set of experiences organized with reference to a set of corresponding names, *which were learnt by heart*, the noting of details in a similar object presented afterwards was facilitated. The reports of the students on their experiences during the experiment show that the lectured group armed with the memorized system of names, *set out to explore the slides in the second test actively*, to discover whether parts corresponding to the names they had learned were present in the figures. Moreover, they *saw* the details more quickly and confidently than the other group in the second test.

One point of considerable interest for teaching-practice emerged in the preliminary tests. Several groups had been tried before a satisfactory experimental procedure was finally decided upon, and in one case the set L was given the lecture and told the names of the typical portions of a suit of armour as these were shown, *but was not given the opportunity of learning the names by heart.* The second test was given soon after the lecture.

In this case the lectured group was little if any better than the unlectured group in the final tests.

The reason seemed apparent from the reports of the students concerned. They found themselves concentrating upon the names, and endeavouring to remember them. They were confused by this effort to recall the names imperfectly known, and attended to this process instead of to the details of the armour.[1] The distraction introduced by the imperfectly learned names hindered the observation. It seems therefore that names will assist observation only when they have been made habitual by use. No effort of recall is then necessary, and the energy aroused is nearly all available for the work of observation. This fact should act as a warning against the tendency to believe that as soon as a clear and systematic exposition has been given by the teacher to a class of pupils, the subject-matter so treated will be perfectly well known and ready to function in future perception. The material needs to be repeated and worked over by the pupils themselves until it is consolidated as it were, and made habitual. Half-learned names and half-organized experiences are likely to interfere with, rather than help, future observation. In addition, the feeling of frustration

[1] *Cf.* Conditions of Attention, p. 195, para. 4.

and annoyance due to the distraction, will further dissipate the energy available and will produce a loss of confidence.

A note of warning is indicated here. The more systematic and specialized is the observer's knowledge, and the more habitual his names, the more is his observation likely to be limited to items within his apperceptive systems. Thus systematic well-grounded knowledge, while it makes us better observers within our own field, tends also *to make us psychically blind to other fields of experience.* The chemist will observe as a chemist, the engineer as an engineer, the lawyer as a lawyer. This explains why an intelligent classical scholar may sometimes note a good deal more about a neutral situation, or even a scientific situation, than a scientific observer who approaches the situation with certain academic scientific assumptions and preconceptions strongly active. Hence the value of observing with an ' open mind.'

SOME PRACTICAL APPLICATIONS OF THE PSYCHOLOGY OF OBSERVATION

The more we introduce manipulative and experimental activity into school-work, the more important will a knowledge of the conditions of good observation become. The application of the principles discussed in the section on observation to routine science-work in the laboratory, as well as to the successful showing of pictures and models is sufficiently clear. We must organize an anticipatory interest ; connect the situation to be observed with previous knowledge (and, if the necessary knowledge is not available, organize it first) ; arrange a correct mental ' set ' for interpretation purposes ; and provide a battery of names. Moreover, particularly with younger pupils, no act of observation can be taken for granted. It is necessary to direct the mental activity of the pupils specifically to whatever items in the situation are relevant to the purpose in view. This direction can be accomplished by pointing, or demonstration, or by instructions to observe, and these measures need to be followed up by some kind of test to ensure that the observation has been made, and made correctly. Students-in-training are apt to take far too much for granted in the pupils they teach.

The importance of these principles of observation has been emphasized still further by the introduction of school-excursions and field-work, and by the growing use of the cinema-projector and wireless-set in teaching. So much of the educative value of

these devices depends on their skilful employment. Casually used they are merely expensive ways of wasting time. Hence a brief discussion of these teaching-devices in relation to the psychology of observation will be included here.

ORGANIZATION OF SCHOOL EXCURSIONS AND FIELD-WORK

In working out a satisfactory piece of field-work, or school excursion, three phases are essential—a preparatory phase, the actual field-work, and a follow-up phase.

Preparatory Phase

The function of this is to organize an interpretative background relevant to the situation to be observed, and to create an anticipatory interest. It is essential that the pupils shall seek for some definite objectives and not merely gaze around. Hence the preparatory phase should consist of:

(*a*) A talk about the general situation to be visited or explored.

(*b*) A clear indication of the purpose of the visit, the points to be looked for, and their connexion with previous and possible future work. Each excursion should have a clear, definite, and limited aim.

(*c*) Working out a 'plan of campaign' with the co-operation of the pupils. If necessary the programme may be noted down in small exercise-books which can be carried easily.

In some cases it is useful to divide a class into small groups, each of which is given a special problem to investigate. In this way, not only is the objective restricted but an element of rivalry is introduced which is an added incentive to take sufficient care with the work.

During the preparatory phase any essential technical terms and their significance should be given to the pupils (*cf.* Fox's lectured group).

During the actual field-work, assistance and direction can be given as required by the pupils.

Follow-up Phase

(i) From notes and rough sketches made during the excursion, pupils should present reports. These may quite conveniently take the form of brief lecturettes and blackboard demonstrations. Incidentally this provides excellent practice in clear exposition and speech.

(ii) The reports may be considered critically by the teacher and the other pupils. Errors of observation can be corrected, misplaced values reduced to correct proportion.

(iii) The results of the observations may be collated, organized, reviewed, and correlated with the problem or project originally proposed, as well as incorporated within the broader subject development.

(iv) Finally, pupils may make some permanent record of the work.

It may be objected that this takes too long. The answer is that one well-conducted and well-followed-up excursion will be richer in real educational results than ten desultory pointless afternoons-out. In some cases the preliminary orientation and the follow-up can be done during term-time, and the field-work during an intervening vacation. For less ambitious projects the field-work can be allocated to evenings, or week-ends. In boarding-schools, such directed activity may provide healthy and stimulating occupations for pupils who are unfit for, or who dislike orthodox organized games.

USE OF WIRELESS PROGRAMMES

Wireless lessons fall into two main groups:

(i) Expository lessons on specific topics, *e.g.*, science, literature, history.

(ii) Background lessons, *e.g.*, travel talks and dramatizations of historical episodes. These aim more particularly at interest, stimulation, broadening the sympathies of the pupils, and linking up school-studies, such as geography and history, with everyday life and general social or economic problems.

The function of the wireless is not to supersede the teacher, but to provide a range and variety of intellectually stimulating experiences for teaching-purposes which would be unattainable otherwise by the pupils. Therefore the wireless lessons must be *co-ordinated skilfully with the main body of school-work.* They should be part of a properly organized school-course.

Since the appeal of the wireless is exclusively to the ear, and since pupils, particularly juniors and the more backward seniors, are most prone to misinterpretation of spoken sounds, the wireless lesson needs careful preparation, and follow-up.

In this connexion the wireless is at a disadvantage compared with a speaker actually in the classroom. The wireless voice is to some

extent impersonal. No aid to interpretation is provided by facial expression and gesture. Moreover, the wireless speaker cannot see his audience and therefore cannot tell how they are responding. The teacher talks to a living class whose responses he can follow from moment to moment. The wireless speaker talks to a microphone.

The wireless lesson to be fully effective (particularly with younger pupils) must be prepared for in advance. The teacher should give some indication of the topic which will be treated, and how it is likely to connect up with (*a*) previous lessons in the same wireless series, and (*b*) the general mental background of the pupils. This indicates a careful study of the printed synopses issued for the use of schools in connexion with the series of talks.

During the presentation *any necessary visual aids* must be provided by the teacher. These include :

Atlases or specimens indicated by the wireless speaker.

Printed synopses, such as those issued by the British Broadcasting Company. Each child should have a copy of the synopsis and pictures for reference during the talk.

Writing on the blackboard any unfamiliar names and phrases not likely to be intelligible to the pupils.

Making a brief blackboard summary of the main points touched upon.

After the talk there should be a follow-up. This should include :

Questioning in connexion with specific points of importance.

Correction of errors and filling in gaps in perception.

Summing-up to ensure that the pupils *comprehend the talk as a whole* and its relation to other subject-matter.

Some form of synopsis (*e.g.*, a summary) to be entered, when desirable, into pupils' note-books as a permanent record. This is more necessary for definite expository lessons than for general travel, history, and civics talks, but it may be an advantage also for the latter on occasion.

Some form of application either suggested by the speaker, or devised by the teacher. Such application might be the preparation of drawings or maps ; study of a suitable text-book or reader ; making of models ; visit to a pond, or a walk in the countryside to look for specimens ; experiments in the laboratory, domestic-science centre, or school-garden.

It is interesting to note that some American secondary schools used weekly evening broadcast talks in a series, " You and Your

Government," as home-work assignments for senior pupils in social studies. The pupils were expected to listen, make summaries, and be able to discuss in class the talk given on the previous evening. The teachers organized listening groups for pupils who had no wireless sets.

This experiment suggests useful possibilities in connexion with subjects like history, economics, public health, international politics, world-affairs, and appreciation in literature and music.[1]

Throughout the use of wireless, attempts should be made to train habits of alert, discriminating, and critical listening. Many of the pupils will already have adopted the complacent, semi-conscious, half-witted attitude of the wireless 'fan.' In far too many homes the loud-speaker is a constant braying accompaniment to every household function from early morning to late at night. People 'listen' to religious services, jazz, comic opera, political and social talks, in the same way as they 'listen' to the clock ticking or to street noises. This makes all the more necessary the skilful specific direction of the pupils' mental activity during broadcast programmes.

USE OF CINEMA FILMS

Cinema films should be presented as a general rule in five steps or phases. These are :

(i) *Introduction or Preparation*

(*a*) Preparatory lessons leading up to the film are required, to organize in the pupils' minds an adequate background for the correct interpretation of the significant elements presented in the film.

(*b*) An introductory talk just previous to the first presentation of the film is indicated. This should deal with :

General purport of the film.
Special points of importance to be looked for.
Difficult technical terms (in sound film exposition) explained and written on blackboard.
Problems which can be solved by observation of the film.

(ii) *First Presentation of Film*

The film should be presented *without a break*.

[1] *Educational Broadcasting*, 1936. (Proceedings of the First National Conference on Educational Broadcasting), Washington, Dec. 1936, University of Chicago Press.

(iii) *Follow-up*

This will include :

Questions about significant facts to emphasize the important points.

Correction of errors.

Further explanation of difficulties revealed by the follow-up.

Discussion emphasizing *comprehension of film as a whole,* and correlation with previous work.

Redirection of attention to weak points in observation revealed by the follow-up.

(iv) *Second Presentation*

This is a most important step.

Now that the general purport of the film has been grasped, attention can be concentrated upon difficulties revealed in the follow-up stage. For this purpose it may be desirable to stop the film at some points, reverse the machine, and re-present specific portions (in *silent* films).[1]

(v) *Final Follow-up*

This will include recapitulation, final summing-up, making some permanent record, and appropriate applications.

It is essential for success that the teacher shall be well prepared. For this purpose a pre-view of the film must be made. Once the film has been seen, its general purport must be clearly grasped, difficulties analysed and noted, and possible applications devised.

Exercises

1. Suggest some tests by which the preferred imagery of a number of pupils could be estimated.

2. Analyse some pieces of descriptive prose or poetry, classify the images used into visual, auditory, tactile, motor, etc., and from your classification estimate the probable preferred type of imagery of the author.

3. Study the spontaneous play-activities of a number of children. What insight does the study provide into the predominant hungers and interests at that phase of development ?

4. Study the spontaneous choice of books and other reading

[1] Sound films cannot be stopped and reversed.

material made by children of a given age. Compare the type of choice at different phases of development.

5. Repeat Exercises 3 and 4, but with children's spontaneous drawings.

6. Study some children of the artistic type and others of the mechanically minded, scientific type. Compare and contrast their play-activities, reading-interests, preferred studies, special abilities, and also their aversions and special disabilities.

What special modifications in teaching, curriculum, and school-organization seem to be necessary for each type?

At what age do the differences in type become noticeable?

Can you find any cases in which a child appears to belong to one type at one period of development, and to the other type at another period? Can you find any children with both types of interest strongly developed?

7. Analyse as clearly as you can all the mental processes involved in:

(i) Solving a cross-word puzzle.
(ii) Solving a mathematical problem.
(iii) Arranging a meal for a party.
(iv) Choosing new clothes.
(v) Making a dress.
(vi) Finding why your car has stopped when it ought to be going.

8. Analyse the conditions which seem to be involved when you 'get an inspiration.' What bearing has your analysis upon the work of teaching art, music, mathematics, English composition, science, and practical manual work.

9. Consult a standard text-book on logic and make a list of fallacies: (*a*) formal, (*b*) material.

For each fallacy collect examples from newspapers, political speeches, advertisements, children's statements and essays, your own beliefs and assertions, scientific text-books, etc.

10. Compare the mental processes involved in translating a Latin 'unseen' passage of some difficulty, and making a qualitative chemical analysis.

11. Compare and contrast the mental processes and logical methods involved in (*a*) a mathematical argument and (*b*) a theological argument.

12. Collect some instances of reasoning by analogy from (*a*) children, (*b*) uneducated adults, (*c*) scientific works in

different subjects, *e.g.*, physics, biology, anthropology; (*d*) books on educational theory.

In each case examine how far the 'reasoning' is determined by (i) ignorance, (ii) complacence, (iii) wish-fulfilment, (iv) practical convenience.

13. Study the spontaneous assertions of a group of infant- and junior-school pupils. Pick out any cases of reasoning you can find. At what age does reasoning of any kind appear to begin?

14. Collect observations from a number of fellow-students who have observed the same situation, *e.g.*, a play, musical opera, cinema film. (Mutual discussion must be avoided before recording the observations.) Compare the replies, and note how the observations are related to previous knowledge, special interests, special abilities of the students concerned. Note not only correct observations but omissions and distortions. Note also the prevailing character of the observations recorded.

15. Repeat Exercise 14 with a group of children. What is the bearing of your results on methods of presentation in teaching?

16. Organize a field-excursion or educational visit.

For infant-school teachers such a visit may provide much realistic experience upon which to base speech-training, reading and composition lessons, drawing, and modelling.

17. Observe a wireless broadcast talk, or a film demonstration given to a group of children. Follow up by oral or written questions. Collect and analyse the answers. Note the following points:

(i) What parts are most readily noted and interpreted by pupils of given ages in a particular district.

(ii) What parts are least readily noted, etc.

From your analysis decide what measures are necessary for children of a given age in:

(i) Preparation for the lesson.
(ii) Helps during the lesson.
(iii) Guidance and follow-up after the lesson.

18. Observe critically a broadcast talk or educational film. Discuss its educational excellence (or failings) with respect to the following:

(i) Suitability of material and presentation for pupils of a given age.
(ii) Selection and order of presentation of material.
(iii) Artistic interest.

What modifications, if any, seem to be indicated?

Books for Further Reference

DEWEY: *How We Think.*
FARADAY: *Experimental Researches in Chemistry and Physics.*
,, *Experimental Researches in Electricity.*
,, *Diaries.*
,, *Chemical History of a Candle.*
GALTON: *Enquiries into Human Faculty.*
JEVONS: *Principles of Science.*
PEARSON: *Grammar of Science.*
MONTMASSON: *Invention and the Unconscious.*
JEPSON: *Clear Thinking.*
FOX: *Educational Psychology.*
McDOUGALL: *Outline of Psychology.*
EVANS AND GAMERTSFELDER: *Logic, Theoretical and Applied.*
STEBBING: *A Modern Introduction to Logic.*
,, *Thinking to Some Purpose.*
TYNDALL: *Fragments of Science.* (Essay on " The Scientific Use of the Imagination ").
BARTLETT: *Remembering.*
WELTON AND MONAHAN: *Intermediate Logic.*
ROSS: *Groundwork of Educational Psychology.*

Special Bibliography

BROADCASTING

Books

Cantril and Allport: *The Psychology of Radio*, Harper, New York.
Educational Broadcasting, 1936, University of Chicago Press.

Pamphlets and Programmes

Central Council for School Broadcasting, 12 Portland Place, London, W.1.

CINEMA

Books

Devereux: *The Educational Talking Picture*, University of Chicago Press.
Brunstetter: *How to use the Educational Sound Film*, University of Chicago Press.
Contains detailed directions for teaching technique.

George: *The Cinema in School.*
Contains suggestions for making moving pictures.
Consitt: *The Value of Films in History Teaching.*

Sources of Information

British Film Institute, 4 Great Russell Street, London, W.C.1.
Central Information Bureau for Educational Films, Ltd., Kingsway House, 103 Kingsway, London, W.C.2.

Pamphlets, etc.

National Encyclopedia of Educational Films and 16 mm. Apparatus available in Great Britain.
L.C.C. Report on Experiments in the Use of Films for Educational Purposes. P. S. King & Son.
British Film Institute Leaflets and Special Reports.
List of Books on Cinematography.
Non-Theatrical Cinematograph Apparatus and Films.
Foreign Language Teaching Films.
Geography Teaching Films.
This list contains catalogue of several hundred films suitable for geography teaching, with addresses of distributors.
History Teaching Films.
Science Teaching Films.
School Science Review, "Free Films for Science Teaching," Vol. XX, No. 77, October, 1938, p. 136.

CHAPTER IX

TRANSFER OF THE EFFECTS OF TRAINING

WE have now to discuss what is perhaps the most important single topic in the whole of educational theory, namely, transfer of the effects of training, or, as it is sometimes termed, formal training or formal discipline.

THE PROBLEM STATED

It is certain that training and practice in some particular performance increase a person's ability in that performance. The improvement due to the training and practice can be measured. Now the problem arises: does training in one kind of performance lead to improvement in *some other* kind of performance *in which there has been no special training*? Or, in other words, are the effects of training *specific* or *general*?

BEARING OF THE PROBLEM

Obviously, this problem has a most important bearing on the relation between school-studies and out-of-school activity. It also concerns the inter-relation between school-studies themselves. For example, if the effects of training are specific then each pupil must be taught all the details of subjects which he will require later. If it could be shown that the effects of training are general, time and effort may be saved by concentrating in school upon one or a few subjects which seem to produce the most general effects.

The solution of this problem bears upon choice of curriculum, methods of teaching, and vocational training.

SOLUTION OF THE PROBLEM BY ARGUMENT

It has always been supposed, both by philosophers and laymen, that at least some kinds of training do produce general effects. Plato thought that a mathematical training made a person quicker to grasp any other kind of knowledge. More recently T. H. Huxley said that a liberal education should make the intellect into a "clear cold logic engine . . . ready like a steam engine to be turned to *any kind of work*."

Actually, the practice of mental testing implies a form of transfer. The psychologist gives a pupil a standard test of intelligence, and as a result of this short test lasting perhaps an hour or less he estimates the pupil's *general* intelligence, and also predicts what the child's probable rate of educational progress and general 'quickness in the uptake' will be. In other words, it is taken for granted that if a child is intelligent in the test he will also be intelligent in any other sort of situation both now and in the future. The precise assumption involved here is that intelligence is a *general* aptitude which takes part in a large number of different actual performances.

The belief in the possibility of transfer has been just as strongly opposed as supported. Those who opposed endeavoured to reduce the arguments of the supporters of transfer to an absurdity. Perhaps the shrewdest and most amusing of such efforts was perpetrated by Sir John Adams. He suggested that the best argument against formal training (*i.e.*, training a person for one kind of work by teaching him another of the same form) was to be found in the way in which sin, vice, and crime are treated as educational agencies.[1]

> What could call into play more of a boy's faculties than orchard-robbing? Almost all the virtues are trained in the exercise of this vice. The necessary planning demands prudence, forethought, caution. The choosing of the right moment implies careful observation, judicious estimate of character, and intelligent calculation of probabilities. The actual expedition demands the greatest courage, firmness, self-control. . . . All the results aimed at in the most liberal education are here secured; no teacher is required; and boys enjoy it. Why does not apple-stealing rank with Latin and mathematics as a mental gymnastic?[2]

What appeared, on the surface, to be the strongest case was held by the people defending the general-training value of the classics who could point to the apparent results of the training—all the illustrious bishops, prime ministers, field-marshals, admirals, diplomats, doctors, lawyers, and so forth, who had been trained in classical schools. This argument is easily refuted, however. These illustrious people came mainly from upper-class homes. There is nothing to show that their success was not due to home-

[1] *Herbartian Psychology*, Chapter V (Formal Education), p. 111.

[2] Sir John Adams was tilting here at the practice of the older public schools in which the boys were prepared for a large number of different careers by teaching them only Latin and mathematics.

training and patronage rather than to a classical training in school. Secondly, the schools and universities were organized almost exclusively on a classical basis. Scholarships were given for classics. The ablest boys were made to take the classics. Therefore the classical organization *selected* the ablest pupils automatically. The success of the classical régime in producing eminent men was just as likely to be due to the *selection* of able people, as to the training. If the same people had been trained in scientific subjects or history they might still have achieved the same eminence.

EXPERIMENTAL INVESTIGATION OF THE PROBLEM OF TRANSFER

Much of the argumentation about the possibility of transfer was completely futile since it was really special pleading. The only profitable approach to the problem was to try to discover the facts. Does training really transfer from one kind of performance to another?

The first experiment was performed by the American psychologist, William James.

> He memorized 158 lines of Hugo's poem, 'Satyr,' the total time required being 131 minutes. He then practised memorizing, about 20 minutes daily for 38 days, learning by heart the whole of the first book of *Paradise Lost*. After this practice he memorized an additional 158 lines of the 'Satyr,' and this time he required 151 minutes. The result was just the opposite to that which would have been expected by hypothesis.[1]

This particular experiment had no great value as evidence, since it was not controlled with sufficient accuracy. However, it stimulated further investigation.

Most of the experiments had a similar type of organization. First came a test for the subject's ability in some kind of performance. Then followed a period of special training with a *different* type of material. Lastly, a second test similar to the first was given and the two test results compared. The kinds of performances and training may be gathered from a few typical examples:

> (*a*) Thorndike tested the influence of training in estimating areas, lengths, and weights of a certain shape and size, upon the ability to estimate other areas, lengths, and weights similar in shape but different

[1] See *Principles of Psychology*, Vol. I, p. 666–7.

in size ; different in shape but similar in size ; different in both shape and size.

(*b*) Several investigators studied 'cross-education,' that is, the improvement in performance with the left hand following training of the right hand.

(*c*) Ebert and Meumann investigated the influence of memorizing nonsense-syllables, upon efficiency in memorizing series of numbers ; series of letters ; series of nonsense-syllables learned by a different method ; series of unrelated words ; series of hieroglyphics ; German-Italian word-pairs ; stanzas of poetry ; and paragraphs of prose.[1]

(*d*) Other experiments were concerned with influence of training in perceiving words containing 'e' and 's' on efficiency in perceiving words containing 'i' and 't,' 's' and 'p,' 'c' and 'a,' etc. ; influence of training in perceiving English verbs on efficiency in perceiving other parts of speech ; influence of training in distinguishing different intensities of sounds upon efficiency in distinguishing different shades of grey.

EXPERIMENTAL RESULTS

Generally speaking, the following results emerged from a mass of experimental work :

(*a*) There was some evidence of positive transfer of ability from the practice to the tests. Working the tests was facilitated by the practice in some cases.

(*b*) *The amount of transfer was surprisingly small*, and occurred only when the practice-material *resembled* the test material *very closely*.

(*c*) Increasing the difference between practice-material and tests caused a *very rapid decrease* in transfer of training-effects.

(*d*) Transfer might be negative as well as positive, *i.e.*, practice in one kind of performance on some occasions was found to hinder efficiency in other performances, even though the two performances appeared, on inspection, to be very similar.

The mainly negative results of the first experiments were received by the general public and by many teachers with horrified incredulity. The results were so contrary to common expectation that they did not seem possible.

Actually, the methods used for carrying out the earlier experiments were rather crude and the statistical control of the conditions left much to be desired. However, in an outstanding series of experiments on memory-training from which the objectionable

[1] For details of this experiment, see Thorndike, *Educational Psychology*, Vol. II, p. 369.

features of the earlier work had been removed, Dr W. G. Sleight confirmed the negative findings.

A number of London school children were chosen for the tests. They were given, first, ten tests in various kinds of memory-work. On the basis of these tests they were arranged into four groups of equal average memory-ability, A, B, C, D.

Each of these groups then had a different treatment. Group A had *no* special training over and above their ordinary school-routine. Group B received daily, special practice in memorizing poetry ; group C, in memorizing 'tables' ; and group D, in memorizing the gist of prose passages.

At the end of the first training period all the four groups were given a second series of ten memory tests comparable in form and difficulty to the first tests. Then a second period of training was pursued by groups B, C, and D, after which *all* the groups took a third series of ten tests similar to series 1 and 2.

Precautions were taken to ensure that groups B, C, and D had equal training-opportunities, and the same methods of treatment.

As a result it was found that :

(*a*) There was some improvement in the tests as a result of the practice.

(*b*) The improvement occurred only in those tests which were similar to the practice work.

(*c*) *In some respects, the unpractised group* A *improved as much as the practised groups* B, C, *and* D, showing that the experience gained in working the tests themselves was as powerful in its effects as the special training.

(*d*) There was *no* indication of any *general improvement* in memory-ability as a result of the special training. This implied that there could be no general faculty of memory responsible for all the various kinds of memory-ability.

(*e*) There were indications of the presence of negative transfer.[1]

In the case of *simple dexterities*, recent carefully controlled experiments have also confirmed the results of the earlier investigations.[2]

[1] "Memory and Formal Training," *British Journal of Psychology*, Vol. 4, pp. 386–457.

[2] Langdon and Yates, "Experimental Investigation into Transfer of Training in Skilled Performances," *British Journal of Psychology*, Vol. 18, p. 422. See also Industrial Health Research Board Report, No. 67.

INTERPRETATION OF THE EXPERIMENTAL RESULTS

In these experimental results two main points seemed significant:

(*a*) There was some evidence of positive transfer from the training- to the test-situations.

(*b*) The amount of transfer was invariably small, and decreased rapidly as the difference between the training and the tests increased.

Hence it was supposed that the cause of what positive transfer did occur was the presence in both training- and test-situations of common elements, or better, common components. These common components might be:

(*a*) *Of Content*

(i) Identical items of knowledge, both material and formal.
(ii) Identical habits.
(iii) Identical or very similar methods of work, and methods of presenting the practice- and test-work to the persons tested.
(iv) Identical attitudes, sentiments, and ideals—for example, the persons who proceeded with care in the practice-series also proceeded with care in the test-series; persons who worked conscientiously in the practice-series also worked conscientiously in the test-series, and so on.

(*b*) *Of Aptitude*

If all abilities are possible by reason of the nervous system, then the common components causing transfer might be identical nerve-elements involved in both the practice- and test-performances.

OBJECTIONS TO THE EXPLANATION OF TRANSFER BY COMMON ELEMENTS

The supposition that the presence of common elements in the practice- and test-situations is the sole or even sufficient reason for transfer of ability is open to serious objections.

It can be demonstrated that in many cases *no transfer of ability takes place when identical common elements are present in the training and in the test-situations.*

Elements of complex perceptual situations are not mechanical units in a mechanical aggregate. Such elements cannot be removed from one setting to another without some degree of *qualitative*

change. If a grey vase is viewed first against a scarlet background, and then against a green background, it will not appear to have the same colour in both cases. A sheet of black paper can be made to appear lighter than a sheet of white paper by arranging suitably the conditions under which the two are viewed. The same physical thing may appear to be several different perceptual objects according to the context in which it is observed, and *according to the observer's own mental condition at the time.* Thus the common objective elements of content in two or more different situations *may not be recognized as common perceptual elements* by the observer. In this case no transfer of ability will occur.

There seems no better case for the supposition that transfer is caused by the operation of the same components of the central nervous system in both the training- and the test-situations.

Lashley, an American authority on the anatomy of the nervous system, has shown that if rats are trained to run a maze, and then deprived by surgical operation of various parts of their upper brains, they can still run the maze successfully although it may be traversed " by a method of progression which involves no patterns of muscular movement that can be recognized as identical with those utilized in learning." [1] The author goes on to say that, in the doctrine of common elements which has been so widely used to explain the transfer of training,

> It is held that the stimuli may be diverse, but certain elements of each stimulus activate the same sensory paths exciting identical nerve cells and so eliciting the same reactions. The conditions of visual stimulation [in certain experimental studies of transfer in rats] seem absolutely to preclude any such common nervous elements, and it is equally difficult to find them in many cases of motor transfer. . . . *The common elements in transfer are not common neurons.*[2]

Summarizing again—it is not disputed that different performances may contain common items of knowledge, and common items of habit. It is not disputed that different performances may involve common nerve-elements. What is disputed is the belief that common items alone, whether of knowledge, habit, or nerves, are *sufficient* reasons for the transfer of all or any of the effects of training.

In reply to these objections it has been suggested that the cause of transfer is the presence of *usable* common elements in the training-

[1] *Foundations of Experimental Psychology*, p. 544.
[2] Work cited, p. 545. (The italics are mine.)

and test-situations. This suggestion, however, begs the whole question. We are still left with the problem of finding *what makes the common elements usable.* If this factor can be found the real problem of transfer will be solved.

Several notable contributions to the experimental investigation of this latter problem have been made. These have so direct a bearing on the principles of teaching that they are worth considering in some detail.

LATER EXPERIMENTS AND RESULTS

1. In an investigation on " The Effect of Type of Training on Transference " Woodrow tried to find whether the *kind* of training given had any influence on transfer.[1] He begins his report by referring to the fact that Sleight had shown that practice in one kind of memorizing failed to produce any facilitation of other kinds of memorizing, and then asks,

> Does this mean that the same conclusion is valid *no matter what type of practice is used* ? Does it hold for practice accompanied by explanation of methods, and illustrations of how these methods should be applied in the performance of tasks other than the one in which the individual is drilled ?[2]

The author adds, " May not the general problem . . . be stated as the problem of the difference with respect to the resulting transfer [of training] between unenlightened drill, and intelligent teaching." This statement of the problem brings the whole issue very closely into relation with the principles of teaching-method.

Woodrow's experiments were designed to investigate *the possibility of teaching some general methods* of memorizing. The object was to show that " training in memorizing can be given in two such widely different ways that in the one case the individual will benefit little, or not at all, and in the other case, enormously, when he turns to *new* kinds of memorizing."

One hundred and eighty-two university students were used for the experiment. They were arranged into three groups—the Control group (106 students), the Practice group (34 students), and the Training group (42 students).

All the students were given initial tests for ability in (1) learning poetry by heart, (2) learning prose by heart, (3) remembering facts, (4) memorizing a Turkish-English vocabulary, (5) memorizing historical dates, and (6) immediate memory for consonants. Note that the initial

[1] *Journal of Educational Psychology*, Vol. 18, 1927, p. 159.

[2] Place cited, p. 159.

ability of the Training group was *less* than the initial ability of the Practice group in all the tests except memorizing prose.

The Control group had no special practice. They merely tried the initial and final tests in order to provide a measure of the effects upon the second test of doing the first test, apart from the effects of special practice.

The Practice group spent 177 minutes, divided into periods of about 22 minutes, twice a week for four weeks, in routine memory-practice with poetry, and nonsense-syllables. They had 90 minutes practice in poetry, and 87 minutes' practice in nonsense-syllables. Their instructions were to *learn by heart as well as they could. Nothing more was said to them.*

In the case of the Training group, the same period of 177 minutes was divided up as follows: for a total of 76 minutes they listened to an exposition on rules for effective memorizing and *illustrations of how the rules could be applied in practice*; for 76 minutes they practised memorizing poetry; and for 25 minutes they practised memorizing nonsense-syllables.

Thus, with the Training group, an attempt was made to give them a thorough grasp of some economical methods of memorizing, and all their practice was done *with the explicit purpose of applying the rules which had been discussed and illustrated.* They had 76 minutes *less* practice than the Practice group. Their practice material was the same as that used by the Practice group, namely, poetry and nonsense-syllables. The difference between the Training group and the Practice group was in the instruction received by the Training group *in general methods of efficient memorizing*. So far as initial ability in the tests and the time allowed for actual memorizing were concerned, the advantage was decidedly in favour of the Practice group.

After all the students had completed the second series of six memory-tests the following results emerged:

(*a*) The Practice group improved sometimes more, sometimes less than the Control group. In two cases the practice-periods had interfered with the results in the second test.

(*b*) The differences between the Practice and the Control group were insignificant in all but one of the six tests.

(*c*) In spite of the disadvantages already referred to, the Training group decidedly *excelled* the Practice group in *every one of the six tests*. The average net improvement (*i.e.*, after the effects of the first test had been allowed for) of the Practice group was 4·5 per cent. The average net improvement of the Training group was 36·1 per cent. The actual degree of improvement varied from 17·5 per cent. to 51·8 per cent.

The investigation shows in a convincing way that transfer may happen, not by mere practice in memorizing, but by practice

informed by general methods of sound procedure which have been explicitly abstracted and deliberately used by the learners. In the case of the Training group the improvement in ability to memorize, due to training in poetry and nonsense-syllables *only*, was positive and *general*.

2. The next piece of evidence to be submitted deals with transfer of training-effects in a manual occupation. It is contained in a careful study by J. W. Cox of the acquisition of manual skill. In addition to direct confirmation of the transfer of training-effects, this work indicates very clearly the type of teaching-method which produced the transfer. It is, therefore, of particular interest to teachers of handicraft, physical training, and games.[1]

The subjects of the investigation were groups of adults and of school children, both male and female. They were practised and tested in various elementary dexterities involved in the assembly of an ordinary electric light bulb-holder. The gist of those parts of the investigation dealing directly with the problem of transfer of training is given below.

The author begins by making a very significant distinction between 'practice' and 'training.'

By 'practice' is meant the mere repetition of routine-exercises at maximum speed for a given time, *with no instruction of any sort concerning how the exercises might best be performed*. The 'practised' workers were left to their own devices.

By 'training' is meant exercise together with an organized course of instruction about good methods of procedure.[2]

Hence the problem of transfer can now be reduced to two separate subsidiary problems :

(*a*) Do the effects of *practice* transfer from the mechanical operations practised to other mechanical operations in which there has been no practice ?

(*b*) Do the effects of *training* transfer from mechanical operations in which there has been training to other mechanical operations in which there has been no training ?

PROBLEM (*a*)—TRANSFER OF PRACTICE-EFFECTS

The assembling work was divided into six specific mechanica operations which we will label *a*, *b*, *c*, *d*, *e*, *f*. The workers were tested

[1] *Manual Skill, Its Organization and Development.* See particularly pp. 30–37, 141–146, 162–177.

[2] *Cf.* Woodrow's experiments.

for their initial ability in all the six operations. They were divided into five groups. Four of these groups then each practised *one only* of the operations *a*, *b*, *c*, or *d* intensively during eleven daily working periods. The fifth (control) group had no special practice. At the end of the practice-periods all five groups were given a second test in all six operations.

The tests showed that, as in Sleight's experiments, while the practised groups showed some improvement in the unpractised operations *e* and *f*, this was *nowhere significantly greater than the improvement in operations 'e' and 'f' made by the unpractised control* group. Cox states that nowhere was there any significant evidence of practice at one operation bringing about improvement in another operation.[1]

PROBLEM (*b*)—TRANSFER OF TRAINING-EFFECTS

For this problem a new set of workers similar to those used in the practice-experiments was collected. They were tested as before for initial ability in the six operations *a* to *f*. Instead of the pure practice-periods, eleven daily training-periods of the same length were substituted. These had the form of eleven lessons, the aim of which was to *impart knowledge of certain general principles of skilful handling of material*. These general principles were then applied by the trainees in a series of exercises involving *one* assembly operation only. The training-exercises were of five types:

(i) *General methods*. These dealt with such matters as the arrangement of parts on the work-bench; the order of assembly; manner of holding the parts, etc.

(ii) *Eye-observation exercises*. The trainees were instructed to *look* carefully and *pay specific attention to* aspects of shape, and relations between them.

(iii) *Finger-observation exercises*. In these the trainees were instructed to *pay specific attention to feelings in the fingers* as the movements were carried out, and to note carefully certain aspects of these experiences. *Just exactly what to notice was made clear in each exercise.*

(iv) *Exercises in control of attention and effort*. The trainees were told how these could most economically be employed throughout the operation.

(v) *Application exercises*. In these the trainees practised the application of the exercises in method of procedure (i to iv above) to the one assembling operation chosen for practice, under normal working conditions.

Each lesson opened with a brief verbal revision of the chief points already dealt with. Attention was then directed to the point of the

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[1] Work cited, p. 146.

next exercise. This was explained and demonstrated by the instructor, Next, exercises were carried out by the trainees, special attention being directed to the point in question. Each exercise was repeated several times, the whole process being treated as an observation exercise rather than as one of mere speed. After all the exercises had been completed (in eight to nine days) the remaining lessons were devoted to revising the chief points, and dealing with bad methods observed in various individual trainees during the course of the learning.

Thus, the training consisted of talks and exercises based upon *one* operation only, together with eighty-five repetitions of this operation. The former subjects in the practice experiments, who constituted the control group, had had 440 repetitions of the operation.

Finally, the trainees had a second test of ability in all the six operations *a* to *f*. The individual workers in the trained group were paired off with individuals in the practised groups of the first experiment, who had the same initial ability.

Cox's experiments showed quite clearly:

(i) That repetition without enlightened instruction in methods of work produced no significant transfer effects.

(ii) That when enlightened training was substituted for routine practice, then,

- (*a*) The trained workers were much superior in all the six operations to corresponding members in the practised group having the same initial ability.
- (*b*) The trained workers showed a more rapid rate of improvement.
- (*c*) The rate of improvement of the trainees was much greater than was expected from the general run of improvement shown in the previous experiment.
- (*d*) The trained group excelled from the first day of practice and maintained a higher rate of progress afterwards.

This investigator sums up the results of these two experiments as follows:

> Skill developed by the mere repetition of one manual operation confers little advantage in the performance of other operations that may subsequently be undertaken. Where, on the other hand, repetition is replaced by suitable instruction, the skill thus developed at no additional cost in time tends to transfer to other operations over a fairly wide range of manual activity. . . . These results appear of great practical significance wherever work requiring manual skill is involved, especially when it is remembered that the limits of proficiency to be attained by training, may far

> exceed those attainable by uninstructed repetition. The results indicate the wastage that must be produced by the customary practice of allowing beginners . . . to drop into the work as best they can. They suggest that a very real advantage would follow from the replacement of this current crude procedure by a short course of systematic training in the general principles underlying manual control, illustrated by specific examples from manual operations. A like procedure may frequently be adopted with advantage in other forms of manual activity, such as the work of our scholastic manual-training centres, and 'coaching' for games, where the so-called instruction offered resembles 'practice' rather than 'training.'[1]

3. The third investigation to be described confirms Cox's experimental results, but it is specially important since it deals with teaching-methods in an academic subject, in everyday school-conditions.

G. P. Meredith set out to find what influence *consciousness of method* exerted on transfer of ability to define meanings of words.[2]

Sixty boys, aged thirteen to fourteen years, in a Leeds elementary school were first given a test of general intelligence. In addition their intelligence was estimated by their teachers. On the results of these two estimates they were divided into three comparable groups of twenty each, *A*, *B*, and *C*, of equal average intelligence.

All the boys were then given the first test to determine their ability to define ordinary words. The test consisted of twenty nouns in common use. The instructions were "Define the following words; that is, say what they mean." The scores were reckoned in *errors* of definition so that a lower score indicated improvement in ability.

Group *A* formed the control group. They received no special training. Groups *B* and *C* were then given three lessons in experimental magnetism. Each lesson included five experiments which were performed by the boys themselves. In the case of both groups *B* and *C*, a few minutes at the beginning and ten to fifteen minutes at the end of each lesson were devoted to discussion of the experiments and the inferences to be drawn from them. In the case of group *C*, however, *the question of definition itself was explicitly discussed in each lesson.* The question arose naturally out of the first lesson, in which the properties of magnets were discovered, since it was necessary to state in precise terms what things were magnets and what were not.

Before they began their experiments the boys in both groups

[1] Work cited, p. 176.

[2] "Consciousness of Method as a Means of Transfer of Training," *Forum of Education*, Vol. V, No. 1, Feb. 1927, p. 37.

B and *C* were told to write down their definition of a magnet. These definitions were collected and discussed in the next lesson.

At the end of the first lesson, some pupils were asked how they had defined a magnet. Their definitions were discussed to find how far they agreed with the facts discovered in the experiments. In group *B* the discussion stopped at that point. In group *C* it was continued to a further stage when the *form of a definition was analysed and its essential features explicitly noted.*

The experiments in the second lesson dealt with the strength of magnetic influence, thus introducing the notion of a unit of magnetic force. With group *C* the subsequent discussion about the definition of a unit carried the analysis of the characteristics of a correct definition a stage further. The third set of experiments introduced the problem of defining a semi-abstract term such as ' magnetic induction,' leading in the case of group *C* to a further and final analysis of the form and characteristics of a good definition, the various items being written down on the blackboard.

Hence, both groups *B* and *C* performed the same experiments, and both had practice in defining various types of scientific terms. But in group *B* the practice was incidental and *no explicit reference to definition as such* was made. On the other hand, group *C* were trained in the process of correct definition by means of practice in defining, *a critical analysis of actual definitions*, and finally, formulation of the essential characteristics of a good definition.

At the end of the series of three lessons all the groups *A*, *B*, and *C* were given a second test in which they were required to define another twenty words in common use (not scientific terms) comparable in difficulty with the first test series. It was found that group *B* had made an average *increase* of 3 errors as compared with the control group *A*. This difference was only twice as great as its probable error, indicating that there was *no more than a chance difference* between the two groups. The incidental practice had produced no transfer effect on the members of group *B*. Group *C* made an average improvement (decrease in number of errors) of 12 as compared with group *A*. This difference is eight times its probable error, indicating that a difference as great as this is likely to be due to pure chance only once in many thousands of trials. Hence the *explicit* training in definition leading to a *consciousness of the correct method of defining*, produced a marked degree of transfer of ability from the science lessons to the definition of common words.

Other experimental work has been performed which bears out

these findings. Lack of space forbids further detailed reference, but readers interested can follow up by referring to the original papers.[1]

SUMMARY

Certain very significant features emerge from a comparison of these later experimental researches. We can summarize them as follows:

Transfer of the effects of training does occur in appreciable amounts when:

(*a*) Practice is supplemented by enlightened training.
(*b*) The purpose of the training is made clear to the learners.
(*c*) The *alert attention of the learners is directed specifically* to certain components in the training-situations which are capable of general application.
(*d*) These general (or formal) elements *are explicitly grasped and abstracted by the learners.*[2]
(*e*) The possibility that these elements in the training-situation can be applied to other situations is indicated clearly to the learners. The latter then adopt the *active attitude of looking for opportunities to use them* wherever they can.

Speaking generally, these investigations illustrate the fact, which we have already stressed elsewhere, that there is a difference between mechanical routine repetition and *clear intellectual awareness.* The latter is the essential condition of transfer. Transfer is thus one result of full intellectual development.

INTERPRETATION OF TRANSFER—LATEST PHASE. FACTOR THEORIES OF ABILITY

The facts demonstrated by the later experimental work on transfer call for a new interpretation. The conditions for effective transfer can be summarized as follows:

(*a*) There must be present in both training- and test-situations certain conative attitudes—interest in the work, will to do the work, alert critical attending.

[1] C. H. Judd, "Special Training and General Intelligence," *Educational Review,* Vol. 36, 1908, pp. 28–42. Ruger, "The Psychology of Efficiency," *Archives of Psychology,* No. 15. An abstract of this paper is given in Thorndike's *Educational Psychology,* Vol. II, p. 408. Strasheim, *Educational Psychology Monographs,* 1926; see also Spearman, *Abilities of Man,* p. 214. Johnston, "Teaching Pupils the Conscious Use of Technique of Thinking," *Mathematics Teacher,* April 1924.

[2] *Cf.* Chapter VII.

(*b*) An intellectual analysis of both training- and test-situations is essential. This analysis serves to isolate, bring to clear explicit awareness, and to abstract certain components in the training-situation. These components are then recognized as being components also of the test-situation in spite of the fact that they may be present there in a different setting.

Hence it would seem that the effective factors in the transfer are not only the common components in the training- and test-situations, but also some common ability or abilities in the performer. Now any manifest ability presupposes a corresponding set of aptitudes. Hence transfer requires the operation in both training- and test-situations of one or more common aptitudes.

This was the real assumption implied in the supposition already noted, namely, that the effective cause of transfer was the operation in both training- and test-situations of common nerve-elements. This assumption has been shown to be false. What then are the common aptitudes which would seem to be implied by the fact of transfer?

An answer to this question has been suggested by the modern methods of factorial analysis of abilities. Spearman has been a pioneer in the development of this powerful method of research, and his two-factor theory of ability seems to agree with the facts of transfer.

A great many human abilities of very different types (varying from complex reasoning to crossing out *e*'s on a page of print, and sorting cards into different suits) have been measured and their inter-relations in the same people estimated. As a result of the mathematical analysis of these measurements Spearman has suggested that all human abilities *in so far as they involve intellection* are the resultants of two types of aptitude-factor:

(*a*) One *general* aptitude (or factor) which enters into every performance (of whatever kind) *which has any intellectual aspect.* This factor has been called *g*.

(*b*) A large number of *independent specific* aptitudes (or factors) each of which takes part in one kind of performance only. These specific factors have been called *s*'s. This, briefly, is Spearman's Two-factor Theory of Mental Ability.

It must be understood that psychologists have discovered indications of other general factors, but these apply to character and temperament traits and *not to intellectual abilities.*

CHARACTERISTICS OF *g* AND *s*'s

So far only the probable existence of the general and specific intellective factors has been indicated. The exact nature of these factors has still to be decided.

However, it has been possible to find out certain characteristics of each type.

(i) *The General Intellective Factor g*

1. It is constant in magnitude for any given individual, but varies greatly from one individual to another. Some people possess a great deal of it, others only a very small amount.

2. It is concerned in both the *clearness* and the *speed* of mental operation. In other words, people having a high degree of *g* will (other things being equal) be able to think more clearly, and work more quickly, in any kind of operation in which *g* is involved, than will people having a smaller degree of *g* in their endowment.

3. All manifestations of retentivity (*i.e.*, memory abilities pure and simple as measured by tests of capacity to *reproduce* past experience) have shown themselves to be *surprisingly independent of g*. Hence, so far as memory pure and simple is concerned, the person with an average or even comparatively small amount of *g* is as likely as not to remember as well as people with a very high degree of *g*.[1]

4. *g* participates to a relatively small extent *in mature people* in sensory discrimination and in motor performances of a simple type. It is necessary to put in the proviso "in mature people," because it is found that in children, sensory discrimination and motor dexterity correlate to a marked degree with performances known to involve a high proportion of the general factor. Whether an act of sensory discrimination or of motor dexterity will involve much or little *g* depends entirely upon *how far it is novel* for the person concerned, or how far the performance has become a matter of memory or habit. For this reason, tests of sensory discrimination and motor dexterity may be valuable tests for *general* ability in

[1] This does not apply to performances where the recall depends upon some process of logical reconstruction, *e.g.*, 'recalling' the formula for simple interest by deducing it from the general principle of proportion. This involves intellective operations of relation and correlate-eduction.

young children, but quite valueless for the same purpose in older children and adults.

5. g has been found to be involved to a *high* degree in *all operations requiring the eduction of relations and of correlates.*

(ii) *Suggested Characteristics of the Specific Factors* s's.

1. Specific factors are always independent of g. Performances involving mainly s's correlate only to a very small degree with performances involving mainly g. If a performance depends wholly on memory and habit, for example, the correlations of that performance with others involving a high degree of g approximate to zero.

2. Every s is independent of every other s.

GROUP-FACTORS

Spearman's original theorem has now been shown to be only a special case and needs to be modified. Evidence has been produced by several investigators of the presence of 'group'-factors. These may be considered to be factors which enter into some abilities but not into all.

Cox[1] found evidence of group factors in a number of mechanical abilities.

In his experiments he gave his subjects a test of general intelligence, several mechanical tests, and three school examinations in ordinary academic subject-matter. *After eliminating the influence of g*, the general intellective factor, from both the mechanical performances and the school-examinations he found there was still a considerable degree of positive correlation between the mechanical tests themselves; none between the school examinations themselves; and none between the school examinations and the mechanical tests.

This suggests that one or more common factors enter into all the mechanical tests. Cox considered that they might be (*a*) an aptitude for dealing with space-*arrangements* and (*b*) an aptitude for dealing with space-*movements*.

To make this concept of general, group, and specific factors clearer we will suggest a simple analogy in the form of a 'factor-pattern.' Let g represent the general intellective factor, *sa* the group-factor for space-arrangement, *sm* the group factor for space-movement. Let any other letter of the alphabet represent other

[1] *Mechanical Aptitude, Its Existence and Measurement.*

possible specific factors. Then the factor-pattern involved in this situation might be represented as follows:

Mechanical Test I	*g*.	(*sa*, *sm*) *b*, *c*.
Mechanical Test II	*g*.	(*sa*, *sm*) *d*.
Mechanical Test III	*g*.	(*sa*, *sm*) *e*, *f*, *l*.
Mechanical Test IV	*g*.	(*sa*, *sm*) *h*, *i*, *j*, *k*.
School Examination 1	*g*.	*u*, *o*, *p*.
School Examination 2	*g*.	*q*, *r*, *t*, *n*.
School Examination 3	*g*.	*v*, *w*, *x*, *y*, *z*.

Thus the elimination of *g* would destroy correlation between school examinations 1, 2, and 3 and between any of these and any of the mechanical tests. At the same time the presence of the two group factors *sa* and *sm* would still provide correlation between the mechanical tests themselves.

It must be understood, of course, that the above 'factor-pattern' is not intended to be in any way an exact representation of reality, but only a convenient analogy for purposes of exposition.

Burt, in a series of tests commenced in 1909, showed that educational attainments might be considered to depend on three different types of factors: (*a*) a general factor entering into all the tests, (*b*) three group factors confined to groups of subject-matter, and (*c*) specific factors peculiar to each test itself. He has repeated his tests recently and subjected the results to the latest methods of factorial analysis and has confirmed his original findings. His group factors are (*a*) an arithmetical (or numerical) factor; (*b*) a manual factor; (*c*) a linguistic (or verbal) factor.[1] The school subject-matter tested included composition, reading (comprehension), reading (speed), dictation, history, geography, science; arithmetic (problems), arithmetic (rules); handwork, drawing, writing (quality), writing (speed).

At the same time, there seems to be no foundation in fact for the existence of any broad 'faculties' of memory, imagination, discrimination, or reasoning.[2]

RELATION OF FACTOR THEORIES TO THE FACTS OF TRANSFER OF TRAINING

Much of the later experimental work on transfer (*e.g.*, the experiments of Ruger, Woodrow, Johnston, and Meredith) was

[1] *British Journal of Educational Psychology*, Vol. IX, Part I, Feb. 1939.

[2] See Hargreaves, "The Faculty of Imagination," *British Journal of Psychology*, Monograph Supplement, 1927.

independent of factorial analysis methods. The common feature of all these experiments was the fact that transfer did not occur unless a process of explicit analysis had first been performed by the persons concerned. In all the cases, transfer occurred when the process of analysis had laid bare in the training-situation the presence and the nature of certain logical forms which were then found to be required in the test-situation. Thus the pupils in Meredith's trained group had their mental activity directed specifically upon the correct form of a good definition; those in Woodrow's trained group upon the correct form of a good method of memorizing; those in Cox's group upon the correct form of a mechanical manipulation.

Now, these logical forms are really complex systems of relations according to which the different perceptual details of both training- and test-situations are found to be arranged. At the same time it has been shown in numerous experiments that the abstraction of logical relations is the significant feature of all the abilities which correlate most highly with the *g* factor.

Hence it seems reasonable to suppose that the effective reason for transfer is the operation of the *g* factor [1] in both training- and test-situations. This would not only account for the cases of positive transfer, but would also explain the comparative lack of transfer in such experiments as those of Sleight, where the tests required mainly memorization and sensory-motor habit, or where the methods of conducting the experiments prevented the operation of the *g* factor.

It would explain also the fact that transfer is never complete. There must be some different specific factors in every different type of performance. The more the two performances involve specific factors the less will be the amount of transfer.

HOW DOES TRAINING ACT?

This possible relation between the factor theories and the fact of transfer of training raises an interesting question, namely, how does training act? The problem arises since it is stipulated that in any individual *g* is always constant in amount. In that case, what is improved by training?

The nature of the improvement due to practice is fairly apparent. Practice acts by inducing habits. It improves the

[1] Or, in some cases of more restricted transfer, of one or other of the group factors. *Cf.* Cox's mechanical aptitude.

speed and accuracy of the performance. It is significant, however, that practice facilitates only the more complex performances acquired during the lifetime of the individual. It seems to have little effect upon the basic sensory-motor mechanisms involved. Any improvement in these seems to be due to maturation, and not practice. (*Cf.* walking and the motor-speech aspects of talking). Hence, practice increases efficiency in a performance up to a maximum limit without affecting the intrinsic quality of the working parts involved.

In any new task, both original reflexes and acquired elementary habits have to be organized into a pattern in conformity with the purpose to be fulfilled by the skill. The function of practice is to facilitate this organization. Successful co-ordinations are selected and repeated, while unsuccessful co-ordinations are dropped and fade out. This explains why knowing exactly what is to be done, and the results of each attempt, have such a marked influence upon improvement through repetition.

Practice in a complex skill does for the human performer what the process of 'running-in' does for the new motor-car engine. Without affecting the quality or the function of each moving part the preliminary running-in articulates the moving parts so that they work well together, and it reduces friction, thus freeing more energy for propulsion.

The effects of training are not so apparent. Since training, and not practice as such, is responsible for transfer it must in some way involve the *g* factor. But if *g* remains constant in amount for any given individual at any specified level of maturity, what is improved by training?

It may be suggested that training speeds up the rate of maturation. Experimental evidence makes this appear doubtful.

Winch tried to find, in the case of some London children, what influence early entrance to school had upon subsequent educational progress. He concluded that children who enter school at three years of age progress neither more rapidly, nor more decisively than those who enter at five years. His conclusion held for various types of instruction—kindergarten and formal, and applied also to the development of good behaviour, and attentiveness.[1] His subjects included children of various social classes.

This view is supported by the experiments of Bühler and others with Albanian children (p. 33 above).

[1] "When should a Child Begin School?" *Educational Psychology Monographs* (Warwick and York, Baltimore).

This leaves us with the further possibility that training releases the potential efficiency of the g factor and enables it to realize its full power. This view seems best to fit the evidence available.

Line's experiments on the perception of visual relations indicated that in any given situation relations may be reacted to correctly *without the precise nature of the relation in question being explicitly grasped, and abstracted.* This latter requires that critical attentiveness resulting in an act of analysis must be brought to bear upon the relation in question.

The experiments of Judd, Ruger, Strasheim, Cox, and Meredith show that transfer does not occur until:

(i) The characters and relations significant for transfer are explicitly recognized and abstracted *in the training-situation.*

(ii) The characters and relations significant for transfer are also explicitly recognized as being *present in the test-situation.*

In the discussion on motivation we found that the human being works according to a principle of least action. That is, so soon as efficiency has reached a level sufficiently high for immediate satisfactory adaptation to any given situation then no further effort at improvement is put forward. That implies that *critical attentiveness* to the situation then ceases.

Now training (meaning organized instruction and practice) implies that the persons trained are being influenced deliberately by teachers who have already grasped explicitly the characters and relations necessary for transfer in both the training- and the test-situations. The experiments of Woodrow, Cox, and Meredith show clearly the method and the function of training. It involves the following procedures:

(i) It disturbs the complacence of the pupils and reinforces motivation, and therefore critical attentiveness.

(ii) It *directs the mental activity of the pupils to the significant components in the training-situation.* It does this both by instructions to attend, and also by clear demonstration of what should be attended to.[1] The demonstration dissects, as it were, the complex situation into its significant elements, and lays the latter bare to the mental gaze of the pupil. Thus, the significant items of knowledge, and methods of working are more easily and adequately abstracted.

(iii) It suggests and emphasizes *attitudes*, as well as methods, of looking, listening, or feeling; of verbalizing; and of applying the results of analysis. By training, these attitudes may become

[1] *Cf.* Cox's 'lessons,' p. 244 above.

explicitly conscious and permanent, and are reactivated whenever any complex situation is presented to the well-trained pupil.

(iv) It makes the pupil explicitly conscious of the existence of high standards of efficiency. Good training supplies ideals and clarifies desirable goals for effort.

Any manifest ability is a complex resultant of an interaction between aptitude factors and environmental influences. The process of training, skilfully carried on, organizes the learner's environment in such a way that his latent aptitudes are given the most favourable conditions for development. Thus, without altering either the amount or the native quality of the *g* factor, training could produce its effects by releasing the latent aptitude to its full potential efficiency. This view seems to reconcile the suggested characteristics of Spearman's *g* factor with the facts of training and transfer demonstrated by experimental investigations such as those we have cited.

Some Educational Bearings of the Facts of Transfer of Training and the Factor Theories of Ability

The later experimental researches into the facts of transfer of training, and the factor theories of ability, together make a significant contribution to the solution of a number of major problems in education which have been points of controversy since any written records of educational speculation were made.

Educative Value of Subject-matter—Formal Discipline

We have seen that from very early times there has existed a persistent if not very clear conviction that the effects of some kinds of study were general, whereas those of other kinds were only specific. It is obvious that although the direct and specific value of studies as providing immediately useful technical knowledge and skilled habits is immensely important, yet the indirect general results are still more important for two main reasons. The first depends on the time factor in learning. Pupils spend only a fraction of their time in school. Moreover, in the course of a school-lifetime, they cannot possibly learn everything they may afterwards require. In the second place, the human environment is not static. It changes often with considerable rapidity. That being so, people who cannot adapt themselves and their economic and social institutions sufficiently quickly to meet the demands of the changed environment will perish.

In the long run, power of adaptation is the most significant aspect of human ability for survival. Hence any kind of subject-matter or mode of training which encourages power of adaptation must have a pre-eminent value, particularly in the education of free men (that is, the rulers in the community, no matter whether they happen to be the 'aristocracy' or the 'proletariat'). It is understandable therefore why so much attention has been paid by educational theorists to this problem of the educative value of school-studies. It is imperative to discover what constitutes a liberal education, an education that makes men intellectually free.

The difficulty in solving this problem has been caused partly by the complexity of the factors involved and the lack of any experimental and mathematical methods sufficiently powerful to lay bare the facts. An even greater obstacle has been the effects of political and social vested interests and intellectual snobbery. Much of the argumentation, and, one suspects, some of the experimentation has been undertaken to support an institution or a theory rather than reveal the truth. Educational history shows clearly that, in the first place, subjects are introduced into the school-curriculum because they are at that time economically or socially valuable. The schools are then organized to teach the new subjects, and a settled tradition grows. Naturally there will be opposition to change, and attempts to justify the continuance of things as they are. And, of course, there are always the complacent people who are convinced that the education that made them what they are must be the best possible for everybody else at any time in the world's history.

Most of the controversy about the educative as opposed to the vocational value of subject-matter turns on the fact or otherwise of *formal discipline*. While any given subject-matter is meeting a popular need adequately, no question of its educative value arises, except possibly in the minds of a few philosophers and scientists who are dismissed by the 'practical' people with irritation or tolerant contempt. However, when a new demand for another kind of subject-matter arises the question of the relative educative value of new and old studies at once becomes acute, and the philosophers' and scientists' views are now considered extremely important—by the party whose interests happen to be favoured.[1]

[1] Any readers interested in the study of these crises in educational theory will find ample material in the 'classics *versus* science' dog-fight of the Victorian epoch in England.

Now it is obvious that if the old subject-matter no longer meets the direct practical vocational or social needs of the pupils and their parents, it must be justified on the ground that its indirect, general or formal value is superlative. In other words, the old subject-matter is said to train the 'mind,' or develop the 'faculties' in such a way that the pupil will, as Plato put it, be *generally* more quick to learn anything he may be required to learn. At the same time the advocates of the new studies attempt to prove either that they are better formal instruments for training 'mind' or 'faculties' than the old studies, or else that there is no such thing as a 'mind' or 'faculties' to be trained. In the latter case it would follow that since there was nothing in the mind except particular ideas (items of knowledge) and habits associated together in some mechanical type of arrangement, training could not possibly be general, and studies could have no formal value.[1]

With regard to the existence of broad faculties of memory, imagination, reasoning, and so forth, experimental evidence seems quite definitely against the notion.[2] Hence it is desirable to re-examine this concept of formal discipline in the light of recent experimental work. We may thus get more light on this perennial problem of the educative value of studies.

WHAT IS FORMAL DISCIPLINE?

We stated, previously, that 'to discipline' means 'to bring under control.' This implies that something is brought under control, and in relation to some end to be achieved by the discipline. What then is brought under control, by whom, and for what purposes?

Ultimately the items controlled are human aptitudes, but these can be expressed only in the form of ideas and habits. Thus through these ideas and habits the aptitudes are 'shaped,' that is, organized into a workable system by means of training and practice.

It has been proved, however, that certain ideas and habits can and do transfer from one situation to another, the most significant being those concerned with logical principles and general methods of procedure, in which, while the actual details of content

[1] This was the assumption underlying the organization of the earlier experimental work on transfer of training.

[2] See Hargreaves, "The Faculty of Imagination," *British Journal of Psychology*, Monograph Supplement, 1927; also Sleight, *Memory and Formal Training*, place cited.

(*i.e.*, specific ideas and movements) may be different, the *form of arrangement or relation* is similar (*cf.* the experiments of Woodrow, Cox, and Meredith). Hence we can give a meaning to formal discipline. It means the learner's control over *general* ideas and *general* methods of procedure which is made possible by training and practice with subject-matter and activities which embody the ideas and methods in question. The kind of training necessary for effective formal discipline is training in abstraction.

Therefore we can distinguish between the formal and material values of different kinds of subject-matter. Some subjects do embody a greater number of general ideas and general principles of procedure than others, and therefore *they offer more actual analogies with specific environmental situations* than other subjects. Thus, for the purposes of a scholarly linguistic discipline *required for the solution of problems involving Western European languages*, Latin has more formal value than any one modern language. Similarly, the study of physics or biology has a greater formal value than, say, mineralogy or the metallurgy of copper. To this extent therefore that they may provide a more effective formal (*i.e.*, general) discipline Latin, physics, and biology have a greater *educative* value than English grammar, mineralogy, and the metallurgy of copper.

But, and this is where the partisans of some particular subject have gone astray, these formal values cannot exist apart from the person trained, his aptitudes and interest.

It has been shown that the process of abstraction which is essential for transfer does not take place automatically. The degree of abstraction, and the generality of the items abstracted depend upon (*a*) the aptitudes (mainly the *g* factor) of the learner and (*b*) the efficiency of the training- and teaching-methods.

Therefore, we cannot ascribe absolute formal disciplinary value to Latin or any other subject. It may possess formal disciplinary value for those pupils who possess the necessary aptitudes and who have been efficiently taught, but in the absence of these conditions the concept of formal training is meaningless. Thus it is difficult to understand how physics can have any formal disciplinary value for a person not sufficiently intelligent to abstract the principles of the lever, although he may be taught by practical demonstration how to shift a weight with a crowbar.

Our studies in motivation indicate another weakness in the earlier claims of partisans of special subjects concerning the dis-

ciplinary values of different kinds of subject-matter. We saw that there is a connexion between interest, and aptitude.

Now, without a minimum, at least, of interest, discipline will not be achieved, since sustained practice is needed to bring the items involved under control. In the absence of interest, the person concerned will not put forward sufficiently intense and persistent effort. But sustained interest depends upon at least a minimum degree of success. Persistent failure, or even non-improvement produces strong aversions. Hence no high degree of discipline, either general or specific, will be achieved without aptitude for the work in question.

This brings us to the significance of group factors. Evidence has been quoted in support of four such factors, namely, numerical, manual, verbal, and mechanical. The researches of Burt, Cox, and others seem to imply the following interpretation. In a large class of pupils *with equal amounts of g*, some may be also well endowed with all the group factors. On the other hand, some members of the class may be deficient in one or more group factors. In the latter case if a series of tests involving these group factors is arranged in such a way that *each test is equally easy from the point of view of general intelligence*, then those pupils lacking in any particular group factor will do relatively badly in the tests which involve that factor, irrespective of their general intelligence.

Hence we cannot conclude that one and only one kind of subject-matter, either classics, mathematics, or science, is the best medium for formal discipline and a liberal education for *all* pupils, irrespective of their aptitude endowments.

For a good general education it would seem that a well-balanced curriculum should include :

(*a*) Some form of language-study (though not necessarily a foreign language, either dead or alive).
(*b*) Elementary mathematics.
(*c*) Elementary science, including both physics and biology.
(*d*) Some humanistic studies, *e.g.*, history, geography, and civics.
(*e*) Some constructive craft-work.

DIRECT *versus* INDIRECT VALUE OF SUBJECT-MATTER. THE LIMITS OF TRANSFER

In the controversies about educative values some of the protagonists of one or other kind of study have maintained that that study alone was sufficient for a complete liberal education, as

well as for vocational purposes also.[1] The assumption underlying this kind of special pleading is that the subject-matter in question has a quite general range of transfer. If it were true that the mind consisted of a few broad formal faculties which were trained by means of the study in question there might be some foundation for the assumption. The actual evidence, however, is against it. The meagre transfer observed in the earlier experimental phase inclined educational theorists to the opposite extreme, namely, that studies had no formal value. In this case, obviously, a pupil must learn directly all the specific items he will ever require. Indirect training would be meaningless.

Actually, both these extreme positions are incorrect. Some kinds of subject-matter do possess formal value in addition to specific items of knowledge and skill. To this extent therefore they provide, when correctly taught, a formal discipline. Thus, a well-organized and well-taught course in any of the fundamental sciences, *e.g.*, physics, chemistry, or biology should result in the learner becoming explicitly aware of the characteristics of *the* scientific attitude, and *the* scientific method of thinking. If now that student turns his attention to history, economics, or languages there is a high degree of probability that the attitudes and the methods of procedure explicitly learned in the study of science will be applied to the investigation of the new subject-matter.

Thus, Roger Bacon is associated by most people with pioneer experimental work in natural science. But it is significant to note that he was also a pioneer in the study of Greek and Hebrew. The connexion is more than accidental. Experimental science is a method of getting at the facts of nature at first hand. Similarly in an epoch when the study of the Scriptures depended upon questionable Latin translations the man who wanted to get at origins and who had a desire for first-hand knowledge would turn to the study of Greek and Hebrew in order to read the Scriptures in the original versions.

However, in spite of the possibility of such transfer taking place, it can never be complete. Specific items of knowledge and skill, and specific aptitude factors are always involved as well as general components. As we said some time previously, each art imposes its characteristic discipline. Moreover, it happens sometimes that specific habits developed in one discipline positively

[1] See for instance Spencer's first essay, "What Knowledge has most worth?" in *Essays on Education*.

interfere with success in another (*e.g.*, practice at golf is a bad preparation for hockey, and *vice versa*).

Hence it follows that there are definite limits to the indirect or formal values of any one kind of study. A pupil may learn scientific method by studying physics or biology and then apply it to the consideration of history,[1] but if he wishes to become an expert historian he must study the subject-matter of history and not that of science.

The upshot of all this is that we must take into account both formal and material values in choosing subjects for a good education. The educative criteria of suitable subject-matter seem to be:

(*a*) It must make effective contacts with the everyday environment of the pupil.

(*b*) It must embody broad logical principles of knowledge, and general methods of procedure.

(*c*) It must be sufficiently difficult to need sustained effort on the part of the pupil.

(*d*) It must be related to the pupil's aptitudes.

There has been a tendency in recent educational literature to deprecate the indirect formal value of subject-matter, on the ground that any transfer is necessarily small. This tendency seems to be quite unfortunate and misleading. In some cases experiment has shown that transfer can be considerable. Still more important is the fact that the quality and the effects of the transfer may be of the greatest significance for human welfare and for theoretical progress. The transfer of a generic idea from one type of study to another may lead to an extensive reorganization of the latter. The effect may be rather like diverting a stream near its source. The actual diversion may be through only a few degrees in direction, but it may make a difference of many miles at the mouth of the stream.

Hence, in teaching, it is always desirable to emphasize the general components of the subject-matter and show clearly how they can be applied in various branches of study, as well as utilize the specific values of the knowledge and skill in question.

Specialization

Specialization of Studies

Specialization of studies becomes necessary at more advanced stages of instruction on account of the enormous range and variety

[1] *Cf.* the example on p. 339.

of modern knowledge and skill. Recent developments in the analysis of aptitude factors seem also to indicate a psychological foundation for some degree of specialization. At the same time there is opposition to specialization as not being educative.

The danger from an educative point of view seems to lie not so much in specialization of subject-matter as in the *premature specialization of the learners.* Infant and junior schools cannot introduce specialization for two good reasons. The first is that *all* young learners must be provided with some efficient tools for learning. They must be able to read and write. They must be able to do some simple calculation. They must make the first-hand acquaintance of their social and physical environment. In the second place, *it is necessary to discover in each pupil what his special aptitudes really are.* This is impossible unless he has had sufficient favourable opportunities of showing what he can do, and in what direction his interests lie. This requires a general curriculum in the early stages. It is true that special tests for aptitudes have been elaborated and are being more extensively used at present in educational diagnosis. We must remember, however, two facts. The special aptitudes which will mark the learner's bent are not necessarily ripe in childhood. They may take some years to mature. There is possibly a dormant period. Also, formal tests in laboratory conditions are only indications, not necessarily proofs, of aptitude. The results of these tests must be followed up by actual work in some branch of subject-matter before they can be said to be confirmed. Even eleven-plus, the present fashionable age for educational classification, is probably too early for a definitive verdict about any given pupil's real powers. It seems desirable, therefore, that the general education of all pupils should be continued up to the age of at least fourteen years. Then it is more easy to decide with some degree of accuracy, in what direction the pupil's future success is likely to lie. Most pupils give evidence by that age that they are likely to excel in such broad branches of subject-matter as the linguistic; mathematical-scientific; descriptive humanistic; or practical, constructive, and inventive. Thereafter their studies can be organized round their preferred branch or branches of the curriculum.

Specialization of Schools

The psychological and educational justification for specialization of studies makes necessary administrative measures for providing

it in due measure. Special requirements in the shape of materials, laboratories, workshops indicate the need for a more precise adaptation of school-buildings for different educational purposes. Systematization of knowledge and skill in the more advanced grades of study require specialist teachers. These special needs require comprehensive measures of school reorganization. Two alternative systems of administration have been indicated for post-primary education in the Spens Report, namely, (*a*) a multilateral school-system in which a number of separate but related school-institutions will serve the needs of the administrative area, *e.g.*, grammar school, modern school, technical school; and (*b*) a single school-institution with a multilateral organization, *e.g.*, linguistic side, science side, and technical side. Of these the multilateral school-system is easier to administer, and in densely populated areas the tendency is towards that form of organization. In sparsely populated areas economic considerations favour the multilateral school.

There are practical objections to both of these schemes. It is most unfortunate from the educational point of view that a purely linguistic-mathematical curriculum has a high degree of prestige, and the lay public are prone to assume that all the boys and girls in the 'grammar' schools are much more generally intelligent than all those in the 'modern' or 'technical' schools. This quite unwarrantable assumption leads many parents to insist on their children attending a grammar school with a curriculum unsuitable for them, instead of a modern or technical school which would be much more likely to favour their intellectual development and general happiness.

To check this intellectual snobbery, and prevent able pupils in the modern and technical schools from being labelled as intellectually inferior, many people favour the multilateral school. This arrangement, however, will not automatically remove the difficulties. There is still the tendency to force any pupils who can read and write at all into the 'grammar' side of the school and then leave the 'duds' to their own devices. Actually, we need not only a modification in curriculum for the different types of pupils at the post-primary stage but also *a different kind of approach in the teaching of all the subject-matter*. Unless the multilateral school is big enough to be generously staffed there is a marked tendency at the present time to appoint teachers on academic grounds, and they may not understand sufficiently how best to approach the less academically

minded pupils. They are apt to view all post-primary education from the point of view of a University Matriculation or Higher Certificate syllabus.

LIMITS OF EFFECTIVE SPECIALIZATION

There is always an unfortunate tendency to work a good idea beyond the limits of its effectiveness. This is so in the case of specialization of subject-matter. Specialist teachers have their prestige and their reason for existence in their special subjects, and they tend to make them continuously more exclusive. Specialization becomes then an end in itself instead of a means.[1] In the interests of the sound intellectual development of the pupils, specialization should never be allowed to differentiate beyond the point where any given subject—or part of a subject—shows signs of becoming self-contained and isolated from cognate subjects and from the general intellectual and practical life of the community.

Therefore certain safeguards need to be kept in view in organizing a specialist system :

(*a*) Specialization should be within a group of cognate subjects rather than within a single subject, at least up to the standard of the Higher School Certificate, if not of the initial university degree.

(*b*) In presenting any subject, its relations to cognate subjects should be given adequate prominence. In addition the pupils should be encouraged to *look for relations* and use them.

(*c*) Teachers of special subjects within the same school should know what is being done by their colleagues. Otherwise there will be much needless overlapping and some confusion. At the earlier grades of post-primary teaching it is desirable that cognate subjects shall be taught by the same teacher, *e.g.*, Latin and English grammar ; mathematics and physics ; chemistry and biology ; geography and history.

(*d*) In the higher grades of post-primary and in all grades of technical education some attempt should be made to keep the pupils in touch with movements of thought outside their own special studies. Thus students of languages and mathematics need some instruction in general scientific topics ; students of science, in general literature and the humanities. All strictly technical students need to have their attention called to the relation between their vocational skill and its products, and the general economic system of which their trade is only a part. Nowadays, a single

[1] It becomes a medium for the specialist's self-enhancement.

mechanical invention such as the internal-combustion engine can create an enormous displacement in the material and cultural life of the community. In particular, the organized employment of technical inventions for mass-destruction and economic warfare may cause untold suffering and loss of liberty to millions of people. It is one of the tragedies of modern scientific invention that the machines which it makes possible can destroy the amenities of civilized life even more rapidly than build them up. Yet little care is taken to instruct the mechanical and scientific specialists in the relations which may hold between their inventions and their civilization. The satisfactory use of modern machinery needs a clearly realized attitude of social responsibility.

Great skill and care is needed in organizing and presenting these 'cultural' courses. They should be conceived on broad and not pedantic lines. Their aim is not exact and exhaustive scholarship. It is interest and intellectual stimulation. Much good work is being done by wireless talks in this direction. Yet the wireless talks cannot be superior to the living contact of an alert and intelligent teacher who knows not only his subject but also the needs of the individual pupils. The grave difficulty in this work is to find the teachers who have at the same time the necessary scholarship, intellectual vigour, and personal charm. Teachers tend to run to seed in pedantry. Their training and experience lead them to the one notion that a subject cannot be well taught unless the pupils are to pass an academic examination in it at the end of the course.

TEACHING-METHODS

Sooner or later every problem in education with a practical aspect comes down to the same fundamental factors—the personality, intellectual development, and practical competence of the teachers. It is possible to teach classics in such a way as to make it a soulless mechanical grind. It is possible to teach handicraft so as to make it a vehicle for a liberal education. The difference lies in how the subject is taught. What exactly is the difference?

To realize this it is necessary to take note of the fact which has been stated repeatedly in previous discussions, namely, that the human intellect works according to a principle of least action. For progress in intellectual development beyond a rudimentary stage of perceptual experience, a process of analysis is required

which makes explicit the awareness of finer distinctions in characterization of the objects perceived, and of more subtle multiple-order relations between the characters. This analysis, to be successful, needs not only the possession of the requisite aptitudes but also *specifically directed mental activity.* The latter is due partly to the learner's own hungers, but even more to social intercourse. It is commonly observed both in children and untrained adults that characters and relations which are not noted spontaneously can be apprehended easily when they have been pointed out to the learner. This can be tested at any time by requiring children to draw some complex object placed before them, and then calling their attention to differences between their drawing and the original object.

In the practice of instruction therefore there are two essential processes:

(*a*) Presenting educative material for the use of the pupils—whether concrete perceptual objects or verbal material.

(*b*) *Guiding the mental activity* of the pupils towards the significant educative elements of this material. By this means they become explicitly aware of these elements and apprehend them in the highest degree of clarity possible at that level of their development.

This second aspect—guidance—is what distinguishes really effective and intellectually stimulating teaching from mere routine-instruction. It has the effect of turning the learners' mental gaze to the light instead of keeping it for ever towards the shadows.[1]

This preoccupation with the bare facts of the case and the neglect of intellectual guidance is what makes some teaching of history so completely uneducative and so insufferably dull. I listened recently to a lecture on the Punic Wars given to an intelligent second form in a secondary school. The teacher described quite systematically the causes and the events in these wars but did not once, either directly or indirectly, challenge the boys to compare (or contrast) them with the struggle in Spain that was filling the columns of the local newspapers at the time the lesson was given, even though Italian and African troops were again involved. The teacher told the boys about the elephants used for storming purposes by the Carthaginians, but he did not suggest that they were the counterparts of the modern tanks, being used for a similar purpose. He himself had not thought of this, although he agreed afterwards that it was clear enough when

[1] See Plato's allegory of the cave in the *Republic*.

pointed out. In the article "Punic Wars" in the *Encyclopædia Britannica* (14th Edition) it says: "The failure of Hannibal's brilliant endeavour . . . was not due to any strategic mistakes on his part. It was caused by the indomitable strength of will of the Romans . . . and to the compactness of their Italian confederacy which no shock of defeat, or strain of war could entirely disintegrate. It is this spectacle of individual genius overborne by corporate and persevering effort which lends to the Second Punic War its peculiar interest." It would be difficult to describe more aptly the modern concept of 'collective security' and its obvious advantages, yet the illuminating connexion might quite easily be missed by a class of schoolboys intent on the actual details of the wars in question.[1]

Taught as a bare narrative of events, history may be a miserably mechanical study. Illuminated by intelligent guidance it can be made into a first-rate medium for a liberal education.

Hence in teaching we must, first of all, realize quite clearly ourselves what are the significant elements in our subject-matter, and be continually alert to note connexions within the subject itself, and between the subject and other studies. Secondly, we must continually present the subject-matter in such a way as to emphasize these significant elements and their connexions in the minds of the pupils. The reason why Latin and Greek, really well taught by scholarly and discerning teachers, are so powerful as educational media for those pupils sufficiently well endowed to profit by them is that these languages represent not a compendium of rules of grammar but the history of two civilizations which have many vital connexions with the life and thought of modern Europe.

It is from the point of view of understanding his own subject-matter thoroughly and its educational values that the training of the present-day teacher is often deficient. Too much emphasis is placed upon memorizing words for examination-purposes. The examinations themselves require the memorizing of technical details likely to be useful for academic purposes rather than the appreciation of broad principles of a general educative value. This point has been stressed in a number of reports on the professional and academic preparation of teachers.[2]

[1] There seems also an obvious analogy in the unity of the British peoples in the second Great European War. Why not allow the past to illuminate the present when a good instance does arise?

[2] See *The Training of Teachers and Grants to Intending Teachers*, Chapters I, II, and III.

Training Special Abilities

There arises from time to time a clamour that the schools should train powers of attention, observation, imagination, memory, or reasoning. It is assumed that these powers or 'faculties' are capable of a more or less independent mental existence and mode of operation. Thereupon special formal exercises are invented upon which the learners may practise in order to perfect the particular 'faculty' which happens to be fashionable at the moment.[1]

In this connexion it is necessary to insist that these so-called special powers are not elementary abilities or aptitudes, but only broad aspects of mental activity. *It is a 'person' who attends, observes, memorizes, imagines, and reasons;* and, as we have seen, these processes which may be logically distinguishable in thought are not separable in practice. One cannot observe without attending, imagine without memorizing, and reason without observing. It seems clear therefore that it is nonsensical to talk about training these special abilities separately.

Is there any meaning then, in the phrases, "training the attention," "observation," and so forth, and is there any value in devising special exercises for the purpose? Consideration of the function of training would indicate that we can give a sensible and useful interpretation of these terms.

Training attention really means training the *power of attending voluntarily,* since there is no need for any training of spontaneous attending. This involves two aspects, (*a*) training voluntary control of the attention adjustments—largely a physical process; and (*b*) *instructing the child about what he should attend to.* This latter is equivalent to increasing his knowledge about the significant elements in the situation and providing him with a battery of suitable names to aid exploration.

Hence, any special exercises for training attention will really consist in providing opportunities for repeating acts of attention-adjustments with instructions about the best methods of making the adjustments.[2] This is the purpose of the 'silence games' played by children in infant schools. If the pupils can be induced to make repeated attempts to attend with effort, by the law of

[1] Some of Dr Montessori's special exercises in sense-discrimination seem to come rather near to formal training devices for special faculties.

[2] *Cf.* Cox's training lessons and exercises, p. 244 above.

habit these attempts are thereby facilitated and performed with increasing ease.

Similarly, the apparatus used in special sense-training exercises serves to isolate one particular quality of sense-perception from the general perceptual continuum. Thus the learner is enabled to concentrate his mental activity upon that particular quality of experience so that it can be the more easily recognized and abstracted clearly when it occurs in general perceptual situations. For instance if a person is blindfolded and required to identify objects by touch or by smell, the sight-sense, which is usually the preferred method of identification, is put out of action, and specific attention must be concentrated upon impressions of touch or smell. This point can easily be tested by comparing one's attitude when identifying specified coins out of a handful of them by vision, or by touch alone.

So far as training in observation, imagination, and reasoning are concerned, apart from exercises in voluntary control of attention adjustments, and recognition of special sensory qualities, special exercises must serve two purposes: (*a*) provide explicit knowledge about significant characters and relations, and (*b*) give practice in methods of correlate-eduction, and critical examination of arguments.

Thus in observation it is useful to teach pupils to differentiate accurately between what is actually observed at first-hand, and what is really inferred by correlate-eduction from real or imagined fundaments and relations.

For example, in the familiar experiment of burning phosphorus under a sealed bell-jar, after the combustion is completed the water-level rises inside the jar. When children are asked to say exactly what they have *seen* they almost always reply "Some air has gone out of the jar." This, obviously, is not an actual observation but only an inference based on certain remembered appearances and relations recalled from previous experiments. All that it is possible to *observe* is that the water-level has risen within the jar. Further evidence is required before it can be inferred correctly that some air has been removed from the jar.

In scientific and mechanical pursuits it is necessary to supplement the above instruction with practice in using devices for improving the discriminatory powers of the sense-organs, *e.g.*, microscopes, telescopes, micrometer gauges, etc., and with systematic schedules for tracing difficulties or revealing significant

facts, such as can be found in the instruction-manuals for motor-car engines, or in tables of qualitative analysis in chemistry. These schedules are not so much exercises in observation as devices for ensuring that no significant item available for observation shall be passed over unnoted. Providing a dictionary of technical terms serves a similar purpose.

Thus much of the so-called training in observation consists really in providing and organizing relevant knowledge about the situations likely to be observed, and teaching the pupils how to apply this knowledge and their own powers efficiently to practical situations.

Similarly in reasoning, the training consists largely in providing the learner with typical examples of the most common forms of good and bad argument and giving practice in using them to analyse actual arguments.[1]

Special formal exercises in themselves may be of little practical value. A student can commit to memory all the standard syllogistic forms and all the common fallacies, and yet be little the wiser when confronted with a complicated argument not couched in the standard forms. Given some knowledge of the formal elements in reasoning, the training must pass on to practise the actual dissection of everyday arguments. For this reason it is better not to begin training in reasoning with a formal study of the syllogisms and fallacies but with the critical consideration of actual arguments. Organized thus, the training has greater interest and reality and the formal logical rules are then found to be convenient condensations of already existing knowledge, having a recognizable practical significance. By this means the relation between the formal elements and the practical situations is emphasized throughout the training and effective transfer is encouraged.

Exercises

1. Collect instances where some transfer of the effects of training has occurred. Some typical examples are recognition of analogies. (*Cf.* the spread of word-meanings in colloquial speech, *e.g.*, when a person has had a stroke of good fortune he is said to be ' in clover.' Or we speak of a locomotive ' running '; ' running ' water; ' running ' a business-concern. Examine the nature of the transfer in these and similar cases).

2. Collect instances of (*a*) lack of transfer in cases when it

[1] See Jepson, *Clear Thinking*; Stebbing, *Thinking to Some Purpose*.

might be expected to occur (*e.g.*, in presence of common elements of knowledge or skill); (*b*) negative transfer, *i.e.*, where training in one branch of knowledge or skill interferes with the learning of a second branch. (Consider, for example, training in hockey and training in golf.)

How can the lack of transfer or the negative transfer be avoided or minimized?

3. What bearing has the principle of transfer of the effects of training upon the problem of the person whose "mind exists in watertight compartments"? How can such people's mental activity be freed?

4. What bearing has the discussion in this chapter upon the true function of university training?

5. Examine the bearing of the discussion upon the theory and practice of examinations, *e.g.*, entrance-scholarship examinations, school-leaving certificate examinations, university degree examinations.

Is it possible to train a pupil for a specified examination and educate him at the same time? If so, how can it be accomplished?

6. Has an intelligent study of the classics any value for a future scientific specialist?

7. What bearing has the doctrine of transfer as developed in this chapter upon the problem of explaining present-day civilization in terms of the past?

8. Of what value is a study of the history of education for the modern practical teacher?

9. The author of the Book of Ecclesiastes asserted that there is nothing new under the sun! What does this assertion mean, and is there any foundation for it?

Apply your answer to the history of educational theory and practice.

Books for Further Reference

Much of the literature on this topic is now out of date. The following have a historical interest:

Thorndike: *Educational Psychology*, Vol. II.
,, *Educational Psychology* (Briefer Course).
Sleight: *Educational Values and Methods.*
Bagley: *The Educative Process.*

ADAMS: *Evolution of Educational Theory.* (Chapter VII, "The Educational Organon.")
,, *Herbartian Psychology.*
MONROE: *Text-book in History of Education.* (Chapter IX.)
BARNARD: *Teaching and Organization.*

The newer approach may be followed up in the following, in addition to references in the text:

SPEARMAN: *Abilities of Man.*
,, *Nature of Intelligence.*
THOMAS: *Ability and Knowledge.*
HARGREAVE: *British Journal of Psychology,* Monograph Supplement, 1927, "The Faculty of Imagination."
HAMLEY: *British Journal of Educational Psychology,* Vol. VI, Part III, 1936.
Secondary Education (with Special Reference to Grammar Schools and Technical High Schools). H.M. Stationery Office.

SECTION IV

THE MECHANICS OF TEACHING AND LEARNING

CHAPTER X

RECAPITULATION, REVISION, AND REPETITIVE PRACTICE

A. Recapitulation and Revision

MEMORY AND HABIT

The human organism possesses a primary retentivity—the capacity for registering and retaining the effects of experience and movement. On a subsequent occasion images and ideas can be recalled, and movements repeated. Memory is the name we give to the process of registering and recalling images and ideas. Habit is the name given to the process of registering and repeating movement-patterns and performing mental operations automatically. Some psychologists refer to the recall of images and ideas as true memory, and the reproduction of movement-patterns (including speech-movements) *in the absence of imagery* as habit-memory.

It is not always possible to distinguish in practice between memory and habit. The two represent the opposite ends of a series and it is often difficult to say when memory ends and habit begins. In many cases both are intermingled in one complex process.

POSITIVE EFFECTS OF THE TIME-FACTOR IN LEARNING

The passage of time plays an essential part in learning.

1. It has been shown already that no complex perceptual experience is completely apprehended at the first presentation. Perception is not comparable to photography (except in the one similarity that some more or less permanent effect accrues in both cases). Perception is selective. On the first presentation, certain details only are apprehended in the total situation. To make the

perception *clear* and *adequate* the situation must be re-presented, often several times. At each subsequent re-presentation the learner notes more details, filling in the gaps left at the earlier presentations.

2. It has been shown that the relational elements in a complex experience are not fully analysed and abstracted at the first presentation. They may remain dormant for long periods before being analysed clearly and abstracted. Before the relations emerge from obscurity into clear consciousness the related characters and relations must be attended to specifically, compared, contrasted, and reflected upon. After each re-presentation and period of reflection the relations become clearer and attain to a greater degree of abstraction. At the same time relations between relations in an order of increasing complexity are apprehended, enabling the learner to organize his experiences into a complex knowledge system which is the basis of understanding. *The approach to understanding is a process of evolution in which time is an essential factor.*

3. Sensory-motor learning leading to the acquisition of skilled habits is also a process of evolution. We begin with elementary sensory-motor reflexes providedf or in the build of the human body. These must be co-ordinated into new movement systems needing perfect timing and co-operation between the component elements. It is not sufficient for the performer to be able to envisage, merely, the complex movement pattern required for a highly-skilled performance. The elements must be shaped into the pattern by repeated practice during which successful responses are selected and conserved, and unsuccessful responses eliminated.

NEGATIVE EFFECTS OF TIME-LAPSE IN LEARNING

Learning may be considered to be a resultant of two antagonistic tendencies. On the one hand, experiences leave residual effects whereby we add to our knowledge and skill. On the other hand, lapse of time in the absence of re-presentation and practice tends to wipe out the effects of the original experience. If an original experience is vivid, striking, and accompanied by intense feeling-tone it may produce an effect upon the learner which remains throughout his lifetime. Mild experiences, particularly if not noted with concentrated attention, soon fade beyond vóluntary recall.

The studies of medical psychologists concerned with patients in a hypnotic trance, and reports of individuals after very intense emotional crises, seem to indicate that no experience once apprehended is completely lost with lapse of time. However, for

practical teaching-purposes it is sufficient to realize that both ideational and sensory-motor items may fade with lapse of time beyond the voluntary recall of the learner.

FREUD'S THEORY OF FORGETTING: REPRESSION

The assumption that the fading of experiences and sensory-motor habits beyond voluntary recall is due entirely to lapse of time and disuse has been questioned by Freud. He has pointed out facts which indicate that the mechanical explanation of forgetting is too simple to account for all the observed instances of forgetting.

Freud noted the significant fact that *forgetting appears to be selective* in many cases. All past experiences are not equally recoverable at will.

Some ideas seem to spring spontaneously into consciousness with no effort on the part of the thinker. Other ideas are recoverable only by concentrated attention to their associations (*e.g.*, recovering the forgotten address of a friend by thinking hard about the appearance of the friend, or of his house, or of the circumstances in which we last wrote to him). Even in these cases, disuse and lapse of time cannot account completely for the difference in power of recall since some events spontaneously remembered may have happened many years ago, while others difficult to recall may have happened only a few days ago. Differences in the concentration of attention at the time of perception do not completely explain differences in power of recall.

Still other events appear to be forgotten so completely that they do not reappear in consciousness spontaneously, and *cannot be recalled by any effort of will, however concentrated or prolonged.*

Freud startled the psychological world by asserting that these experiences had not disappeared; that on the other hand they were extremely active, and reappeared quite often *but only in a fashion so distorted or disguised that the thinker in question could not recognize them.* He suggested that the events which were forgotten so completely, were events of which the person was ashamed, the recall of which would interfere with his self-esteem, and set up painful conflicts. These events, he said, were not *forgotten* by a passive process of disuse and lapse of time, but were actively *repressed*, that is, thrust out of consciousness by the thinker and kept out.

Freud supposed that mental activity could be thought of as stratified into three levels—conscious, fore-conscious, and un-

conscious. The fore-conscious level was supposed to contain all the experiences temporarily forgotten, but possible to recall. The unconscious level contained the experiences beyond voluntary recall. It was the repository of our dark and shameful secrets. Guarding the egress from the unconscious to the fore-conscious there was, according to Freud, some faculty or operator which he called the *censor*, whose function it was to keep our 'skeletons' in their proper cupboards. A repressed experience could 'dodge' the censor and emerge into consciousness once again only if it were so disguised as to be unrecognizable by this watchful Cerberus who kept the gates of the mental nether regions.

The Freudian theory of forgetting has been clothed in such fanciful terms that its real importance has been neglected. It has served to call attention, however, to the inadequacy of the explanation of forgetting by disuse and lapse of time only. *Motive is a powerful factor in remembering and forgetting.*

We remember most readily what is most satisfying and convenient for our purposes to remember. We forget most completely what we do not wish to be recalled. Both the factor of motive, and the time factor need to be kept in mind when considering the economy of learning.

The Freudian theory of repression applies to sensory-motor degeneration as well as to the forgetting of ideas. For example, many cases of paralysis have been studied in which no organic disease can be traced in the affected limbs. The *capacity* for co-ordinated movement still remains although the *ability* has lapsed. This is known as *functional* paralysis. It is just as though the limbs in question retain their capacity for movement but the patient has *forgotten how to move them.* This is suggested by the fact that during dreams, in hypnotic sleep, or in moments of intense excitement, the patient temporarily recovers (recalls) his normal power of movement. Many instances of paralysis due to shell-shock were of this kind and the Freudian theory of repression was a valuable guide in suggesting methods of medical treatment.

This theory of forgetting is very significant for teaching-practice. It indicates that if we wish pupils to remember we must not only present the material to be learned, vividly and clearly, and take care that it is repeated sufficiently often. We must also make the process of learning pleasurable to the learner. We must make the material worth the effort to learn it and take care that the learner has *no reason for wishing to forget it.*

RATE OF FORGETTING

Experiments have been carried out to estimate the rate of forgetting due to lapse of time.

The material to be learned may include both logical meaningful material such as passages of prose and poetry, and nonsense-material. This latter consists of nonsense-syllables (syllables of three letters specially composed so that they can be pronounced, but which do not resemble common syllables, *e.g.*, zik, naf, yun), hieroglyphics, digits.

The purpose of the nonsense-material is to prevent, as far as possible, the formation of secondary associations. These are associations of similarity or meaning between the material to be learned and already established ideas.

In memorizing a car registration number such as XY4378, one may do so by repeating the letters and digits in their presented order time after time until the performance has become a sensory-motor speech-habit. This is like memorizing by brute force. It depends on primary associations.

On the other hand, we can assist the recall of the number by *associating it with other ideas of long standing.* XY recalls the familiar designation of lines in geometry or axes of reference in co-ordinate geometry. They are the letters immediately before the last in the alphabet. Inspection of the numbers reveals that 4 plus 3 equals 7, which is one less than 8. The last digit is double the first. 3 is 4 less than 7. These are secondary associations and by means of their aid it is often possible to *reconstruct* the whole series when one item only can be recalled.

The experiments are usually conducted as follows: The material to be learned is repeated by the learners until it can just be recited correctly twice. The repetition is then stopped and the learners' attention diverted to other matters so that no further repetitions will be made. At the end of a given time the learners are required to reproduce as much of the material as possible. The difference between what is reproduced, and the original material, represents the loss due to forgetting.

The results show that the normal rate of forgetting is extremely rapid, *particularly in the period immediately after learning.*

Of nonsense-material more than one-third is normally lost in the first twenty minutes; more than one-half in an hour; nearly two-thirds in nine hours; and more than two-thirds in twenty-four hours.[1]

[1] Pyle, *Psychology of Learning*, p. 167.

Of meaningful material, one-third is lost in two days ; one-half in seven days ; and three-fourths in thirty days.

These facts are extremely significant for teaching-practice. Thirty days is about a third of an average school term. Thus, even if the presented material is intelligible, the normal pupil is likely to have forgotten by the second half of the same school term *more than three-fourths of what was presented in the first half of the term* in the absence of systematic revision. Further, if the presented material is new, and abstract, it approximates for the child to nonsense-material. In that case the normal pupil may forget by the end of a thirty-five to forty-five-minute period *something between a third and a half of what is presented during the first fifteen minutes.* This emphasizes the absolute necessity of recapitulating not only at the end of the lesson and revising in subsequent lessons, but also of recapitulating *during the course of each lesson.*

In a previous chapter we have seen how the correct interpretation of new material depends upon ideas already clearly apprehended. Therefore, in a lesson dealing with abstract material arranged in logical form, if significant items presented at the beginning of the lesson are forgotten, what is presented towards the end of the lesson cannot be correctly interpreted. Hence confusion and frustration will supervene and the pupil will develop a distaste for the material which will add the factor of repression to the effect of lapse of time.

Truly, in teaching, to hurry is the best way to waste time.

THE PURPOSE OF RECAPITULATION AND REVISION

For practical teaching-purposes a distinction should be drawn between recapitulation and revision. The processes serve different aims.

According to the *Oxford Dictionary* ' recapitulation ' means " to go over the headings of ; summarize ; go quickly through again (with the implication that the previous doing was deficient or erroneous, or now requires alteration, improvement, or renewal)."

The primary purpose of recapitulation is to facilitate a clear, accurate grasp, by the learner, of the material to be learned, as a whole ; to give a conspectus. Recapitulation should aid understanding rather than memorizing as such. In so far as it aids understanding it also aids recall, but the latter is not its main purpose.

The recapitulation of a lesson or lecture should bring clearly to the notice of the learner, and emphasize, the *significant* elements

to be learned. In recapitulation these significant items are recalled, or re-presented if necessary, (*a*) to test whether apprehension and understanding are adequate, and (*b*) to enable the learner to correct errors and fill in gaps in the previous learning. Thus the pupil is able to select these significant elements, abstract them more clearly, and by grasping their inter-relations weld them into a unity.

Recapitulation is essential both in a single lesson and in a series of lessons, because it may happen that the full significance of the first parts of the lesson or series cannot be grasped adequately until the material as a whole can be envisaged. It is necessary to return and contemplate the first parts in the light of the whole. This is frequently the case in studying a book. Too often, mechanical revision of *all* the presented material is substituted for intelligent recapitulation. If adult students would do more intelligent recapitulation and less mechanical revision they would economize their time, and examiners would find less cause to deplore the parrot-like detail and precision of many quite irrelevant answers to questions.

Revision, on the other hand, should aim at *memorizing* the selected material after its inter-relations have been grasped. Revision plays the same part in ideational learning as practice plays in the acquisition of skill. It off-sets the loss due to lapse of time, secures long retention, and facilitates accurate speedy recall on subsequent occasions. One important result of revision is the establishment of motor-speech (*i.e.*, word) habits.

METHODS OF RECAPITULATION AND REVISION

Recapitulation may be accomplished in several ways:

By question and answer.

By pupils' reports and discussion.

By making a summary which is then examined to stress inter-relations.

By application of the material learned to the solution of problems, theoretical or practical.

The problem reveals the weak points in understanding and forces the learner to reconsider the lesson material with an active searching attitude.

By making a map, diagram, drawing, time-chart, or by constructing a model. This method of recapitulation and summary is particularly useful in history, geography,

and biology. The map, diagram, or model if well constructed displays the significant elements visually and emphasizes their mutual relations.

It is bad practice to leave all recapitulation till the end of a lesson, particularly when the material presented is unfamiliar or consists of many details. It is better to use a progressive-part method of treatment (see p. 300). In this method, the material to be presented is divided into convenient sections (the more complex and unfamiliar the material the shorter the sections). Section I is presented and then recapitulated before passing to section II. At the end of section II both sections I and II are recapitulated together. At the end of section III, sections I, II, and III are recapitulated, and so on. By this method the significant elements of the lesson material are *carried forward continuously* and the pupils find it easier to grasp the significance of the material as a whole.

It may be objected that this method will be tiresome and will destroy interest. This is doubtful. If the material is difficult the most potent element in interest will be a feeling of mastery over the lesson as it proceeds. If each portion of the lesson is recapitulated judiciously, the pupils, with memories refreshed, will carry along with them all the relevant information at each stage of the exposition. They will therefore be in a position to interpret and comprehend the later stages of the exposition. The mastery thus gained will enhance the interest. On the other hand, if vital information given at the beginning of the lesson is forgotten, the pupil is apt to spend the remainder of the time in painful confusion which is the reverse of interesting, and which makes the learner strongly averse to further attention.

Revision may be accomplished in the following ways:

Repeating after the teacher.

This method is suitable for very young pupils whose reading- and writing-habits are not fully established. The repetition can often be organized as a game.

Silent re-reading.

Reading aloud.

Many people whose visual imagery is weak find this method useful since the pronunciation of the words aids the formation of stable motor-speech habits. For this

reason it is *not* desirable to insist that all pupils shall revise silently.

Reciting without consulting the copy.

This is more effective than merely re-reading since it requires active effort to recall, and it reveals precisely the places where memorizing is weakest. These weak places can then be attacked intensively without wasting time in repeating what is already well established.

In reciting without copy it is necessary to have the copy available for reference as soon as the recall fails. Thus *the correct version can be obtained immediately and errors are not repeated.* It is a good plan to allow pupils to revise in pairs, one reciting while the other follows the copy, prompts when recall fails, and corrects any errors as soon as made. Working in pairs adds an element of rivalry to the procedure and brings in a social factor, both adding to the pleasure and zest of the enterprise. In addition both partners will be actively learning, which is more effective than passive repetition.

By writing down or re-drawing.

This method is valuable for pupils with well-developed visual and motor imagery. Also the motor-habits of writing reinforce the motor-speech habits. Writing or drawing is *not a useful method of revision until writing and drawing habits are well established.* Otherwise the attention of the pupil will be directed to making the movements of writing and holding pencil or pen, instead of being concentrated exclusively upon the material to be learned.

By answering a series of questions which demand for answers the items to be memorized.

Frequent short tests of the 'quiz' type are very valuable in revision, since they demand active recall by the pupil, *reveal losses, and provide a measure of progress,* particularly if a record is kept of marks gained in each test. Here again an element of rivalry can be introduced. (See p. 131, para. 5.)

By using the items to be revised in order to attack new work.

This is a useful method of revision in any subject-matter which has a cumulative or logical order, *e.g.*, foreign language, or mathematics. When memorizing

arithmetical tables of multiplication, in addition to specific oral practice in tables, the pupils can revise the separate items by using them to work out multiplication and division calculations. This revision by application relieves the monotony of specific practice, and it encourages active learning.

TIME FOR REVISION SHOULD BE INCLUDED WHEN PLANNING A SYLLABUS

In planning school-work, whether for a single lesson or for a whole term, it is essential to include sufficient time for adequate recapitulation and revision. This is particularly the case in learning foreign languages when new sets of speech-habits must be established. Further, the revisions should be spaced over the whole term. Nothing can possibly be worse from an educational point of view than the practice of leaving revision to one frenzied week of concentrated repetition immediately preceding the terminal examinations.

The proportion of time required for revision will depend upon such factors as age and ability of pupils, amount of previous knowledge, nature of the subject-matter. Generally speaking the more the subject-matter involves arbitrary details not amenable to logical arrangement, the more frequent should be the revisions, and the more time allocated for that purpose.

B. HABITS AND HABIT-FORMATION

ADVANTAGES AND DISADVANTAGES OF HABIT

There has been a strong tendency for school-work to settle into a routine of mechanical repetition. There are several reasons for this tendency. In the medieval schools, books were extremely scarce and writing materials a luxury possible only to the wealthy. In the grammar schools the main subject was Latin, which was commenced, often, before the pupils could read English fluently. Oral repetition and catechism were, therefore, the only methods of conducting school-work. Later, in the early days of public elementary education, the classes allocated to each teacher were so enormous,[1] and the supply of books and writing-materials so

[1] Some elementary school teachers were responsible for classes containing more than 100 young pupils, while classes of 60 to 100 were relatively frequent.

meagre that, again, the teachers were forced to adopt methods of mechanical oral mass repetition. Individual treatment of pupils was almost impossible in such conditions.

The mechanical routine became extremely tiresome and monotonous and produced a profound boredom in the pupils. It is not surprising therefore that there have been, from time to time, furious protests by educational reformers against this form of drudgery. It has been asserted that school-work must be made interesting, and extremists have gone so far as to claim that children should not be required to do any work which is intrinsically uninteresting. In other words, there have been attempts to remove all forms of drill from school-practice.

Further, the disadvantages of habit have been emphasized. Habit is mechanical, stereotyped, and therefore not adaptable to changed circumstances. The creature of habit fails to respond intelligently to changed conditions in which the habits do not fit. Habit has been opposed to intelligent behaviour as if the two types of behaviour were mutually exclusive. Rousseau went so far as to say that the only habit a child should be allowed to form is that of learning no habits, and some ultra-modern educational reformers have tried to put this extreme suggestion into practice. This is another example of the way in which people revolt from an unsatisfactory state of affairs by going immediately to the opposite extreme.

However, in spite of the vociferous claims of extremists, unbiassed observation of mental development shows that extreme informalism does not work satisfactorily in practice. Ideas cannot be expressed clearly without grammar and a good vocabulary, particularly in a foreign language. One cannot reason accurately without knowledge of facts, calculate correctly without knowledge of tables, nor use a dictionary effectively without knowledge of spelling, and of the alphabet. However much we may value intelligence, it cannot function as a purely formal process. We can only be intelligent in practice in so far as we use knowledge and tools intelligently.

It may be argued that there is now no need to learn to spell, nor to memorize facts and tables. Have we not dictionaries to supply words, books of tables and ready-reckoners to supply answers, laboratories in which to discover facts ? This may be so. Yet, in the first place life is too short, and practical needs too urgent to allow us to be continually turning over dictionaries ; looking up

vocabularies and books of tables; performing experiments to give us half-baked results which have already been correctly established by experts years ago. In the second place, *we cannot even use these aids to knowledge with precision and speed unless we have established some habitual skill in using them.*

The plain fact is that well-established habits are necessary for our peace of mind and sanity, as well as mental development. It is desirable, therefore, to emphasize the positive value of habituation.

(1) Habituation increases accuracy and speed of performance.

(2) Habituation makes complex movements more automatic, less and less dependent upon concentrated attention.

Hence, habits are great savers of energy, and the energy thus saved is freed for work on new and more important problems.

Consider a pupil who has never learned the multiplication tables. He is presented with a problem in arithmetic which itself demands concentrated and sustained attention. If the pupil must needs turn up a set of tables and search for every individual item he requires for his subsidiary computations, it is obvious that the energy needed for the intelligent solution of the problem will be frittered away in exasperating searches for items of information.

It is often asserted that a good education should make pupils think. It is just as reasonable to assert that a good education should free them from the necessity for thinking. The ideal education makes the pupil *selective in his thinking.* It enables him to decide when constructive thinking is necessary, and when it is better to memorize and become habituated. The position may be summed up by saying that memorizing and habituation capitalize the results of experience and render them more readily available for quick and accurate application.

We should not hesitate, therefore, to make fundamental knowledge and skills habitual in our pupils, and *for this purpose some drill is essential.* It may be objected that drill is identical with drudgery. This is not necessarily so. In the first place drudgery is unremitting repetition which is *forced upon a pupil without his realizing the purpose which the drill will serve.* In the second place it is well established by the observation of children in free play, and leisure occupations, that instead of avoiding repetition they engage in it spontaneously, particularly *when it enables them to achieve some end they desire.* Many childish games are mostly rhythmic repetition. The repetition is welcome in so far as it develops ability and mastery, thus inducing a feeling of confidence

and success, and satisfying the hunger for self-enhancement. Drill ceases to be drudgery when its useful purpose is clear to the pupil. If it is impossible to make a pupil of a given age realize the purpose of drill, the drill should either be discarded as unnecessary, or postponed to a later, more mature phase of development. But some drill at some time is unavoidable.

THE FUNCTION OF REPETITION IN HABIT-FORMATION

One fallacy which seems to be inherent in the arguments against drill, is the assumption that repetition is nothing but a mechanical process in which constructive observation and thought play no part. This assumption is not accurate, particularly in the early formative stages of habituation. Then, repetitive practice is never purely mechanical. It is invariably selective. No two repetitions are quite identical. Actually a trial-and-error process goes on, during which the learner modifies his movements or his ideas in such a way as to make the performance approximate more and more closely to some standard of correctness and speed which is kept in view throughout the learning-process. In economical learning the intelligent and well-instructed learner is not repeating either ideas or movements mechanically. He is aiming at a goal—a standard of good performance.

No complicated skill is achieved at the first trial although we may have a clear idea in advance of what we ought to achieve, and how we must attempt it. *Actual trial reveals to the learner* (*and to his teacher*) *how far his present ability falls short of the standard, and in what respects his performance differs from the standard.* In other words practice is a device which indicates to the learner a measure of the results of his efforts. Knowing the standard aimed at, and then discovering by trial how far he can approximate to the standard, the learner can, at the next repetition change his responses in an intelligent way so as to correct his mistakes and approximate more closely to the standard. Repetition enables the learner to *select the more successful trials and reject the less successful.* This indicates another reason for providing the learner with good standards, and keeping him acquainted with his results.

In this connexion we must note the importance of *successful* trials. One successful performance which brings a measure of elation and enhances self-valuation is of more value in establishing a habit than dozens of failures. Hence the desirability of encouraging success as early as possible in the learning-periods.

Apart altogether from any 'stamping-in' effect, repetition is essential for *shaping* the performance into a correct copy of the standard.

Using an apparatus which enabled them to show, or withhold, at will, the result of an action, Elwell and Grindley tested the effect of knowing one's results on improvement in skill. They found

No improvement in accuracy of performance without knowledge of results.

Improvement with knowledge of results.

Withholding results after acquiring skill leads to a degeneration of the skilled habit.

They suggest the following reasons for their findings:

Knowledge of results enables the learner to repeat successful actions.

It has a *directive* effect in that it enables unsuccessful trials to be corrected.

It sets up a conscious attitude or mood conducive to accurate performance. Withholding results dissipates this mood.[1]

The third reason seems to indicate the growth of a feeling of confidence and mastery to which reference has been made previously.

THE LEARNING-CURVE

The course of progress in acquiring some form of skill can be studied conveniently by reference to typical learning-'curves.' A learning curve is a graph obtained by plotting some measure of the proficiency attained by the learner, against the length of time occupied in practice, or against the number of practice periods.

Inspection of such graphs reveals two interesting features:

(1) Reversals of progress.

(2) Plateau-periods.

The first feature is illustrated by the graph in Fig. 14.[2] The curve was obtained during an investigation of the course of improvement in typewriting. It shows that *on the whole*, there is a rise in speed of typing roughly proportional to the number of lessons. The day-to-day progress, however, is uneven. On some days the learner's speed shows a rapid increase over previous performances. On other days there are just as pronounced reversals of efficiency. Thus there is, in the case illustrated, a serious drop near the

[1] *British Journal of Psychology*, Vol. XXIX, Part I, p. 53.

[2] Reproduced by Blackburn in *The Acquisition of Skill. An Analysis of Learning Curves*, Industrial Health Research Board Report, No. 73 (H.M. Stationery Office), p. 19.

twentieth lesson, the learner showing no greater efficiency then, than at the tenth lesson. Near the fortieth and fiftieth lessons there are rapid spurts followed again by severe reversals.

These spurts and reversals are due to several factors among which are, enthusiasm with which the practice is attacked; complacence and less effort after a rise in efficiency; determination to make up a loss in efficiency; weather-conditions; room-temperature and ventilation; subjective feelings of cheerfulness or despondency induced by circumstances not connected with the learning (*e.g.*, illness or bad temper of a member of the family); the learner's own state of health; presence or absence of fatigue.

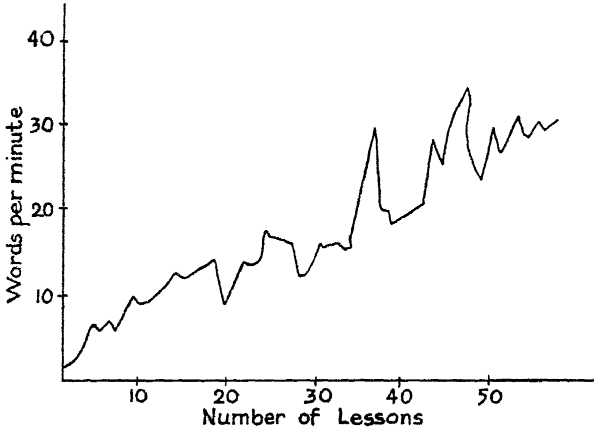

FIG. 14
Showing curve of progress in typewriting.

A good example of plateau-periods is shown by the graph in Fig. 15. It represents the course of improvement in tool-skill of a group of good elementary schoolboys. It shows rapid improvement during the first term's work, almost no further improvement in the second term in spite of continued practice, a second spurt beginning half-way through the third term, and then a long period of no improvement lasting for approximately three terms, followed by a third spurt.

It was supposed that these plateau-periods were inevitable in learning. This view is no longer held. It has been shown that some of the plateaux reported by earlier investigators were due either (*a*) to the conditions in which the experiments were conducted,

or (*b*) to the mathematical procedure employed to estimate the rate of improvement.[1] Further, curves have been obtained in which no plateaux are apparent. *e.g.*, the typewriting curve in Fig. 14 and the curve obtained by Mace for progress in arithmetical addition (Fig. 16).[2]

After eliminating plateaux caused by experimental conditions and methods of calculating results, however, true plateaux are

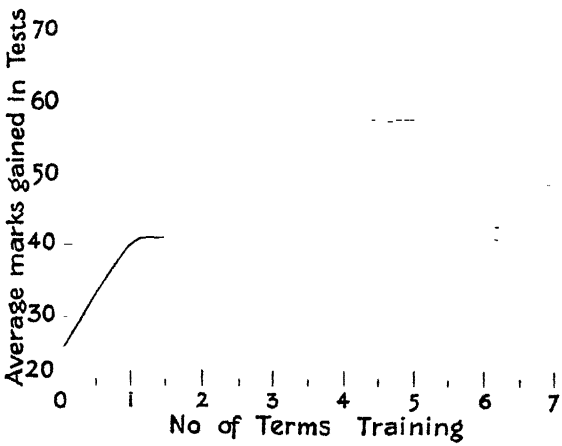

FIG. 15

Graph showing course of improvement in tool-skill of a group of good elementary school boys.[3]

found in learning-curves.[4] These periods of no improvement may be due :

(*a*) To factors *external to* the learning-process.

(*b*) To factors *inherent in* the learning-process.

Chief among the factors in class (*a*) are falling off in enthusiasm and interest ; onset of fatigue and staleness ; accidental conditions causing bodily and mental discomfort ; bad attitudes, *e.g.*, belief by the learner that the limit of improvement has been reached, or complacence owing to the rapid attainment of a too-low standard

[1] Blackburn, Report cited, Chapter IV, p. 27.

[2] *Cf.* p. 131.

[3] From James and Dixon, *Creative Handwork*, Chapter XIII, " An Experiment in Testing," p. 60.

[4] Blackburn, report cited, p. 30–33.

of work, etc. These factors are also mainly responsible for the reversals already noted in a previous paragraph.

The factors in class (*b*) are found to occur in the learning of *complex skills in which many component habits must be shaped into a co-ordinated pattern.* Such factors include :

(*a*) Paying attention to one component of the skill only, to the neglect of other components, *e.g.*, in typewriting it is essential for speed that the learner's attention should be given to the 'copy' to be written and not to the keyboard. The learner's tendency is to attend to the keyboard and neglect the 'copy.' Then there is an oscillation of attention between the copy and the keyboard which prevents the attainment of high speeds.[1]

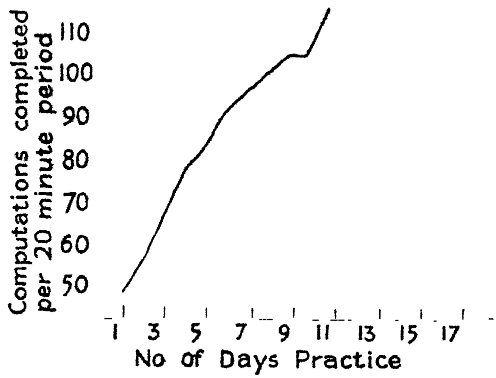

FIG. 16[2]

Showing increase in efficiency in arithmetical addition with practice. (Group of boys, average age=11 years 5 months.)

(*b*) Forming simple 'lower-order' habits which persist unchanged and thus prevent the perfection of 'higher-order' habits. A familiar example in school-work occurs when young pupils copy a passage of prose into an exercise book. The child's natural tendency is to copy letter by letter, or word by word, instead of reading several words at one glance and then transcribing from memory. If the learner persists in using the simpler habit (because it is more easily mastered at first) he may soon achieve some skill in the performance, but the limit *for that habit* is quickly reached,

[1] The same difficulty occurs in learning to play the piano.

[2] Adapted from Mace's Fig. III, p. 21, Industrial Health Research Board Report, No. 72 (H.M. Stationery Office).

and further progress is impossible until a more complex but more efficient habit has been substituted.

(*c*) Changing the methods of performance during the learning-period. One instance of this is the bad co-ordination of the different stages in the teaching of arithmetic.

Suppose that a pupil has been taught multiplication by using the digits of the multiplier from right to left, *i.e.*, in ascending order of place-value. In that case the computation will be set out as follows:

$$1249 \times 371$$

$$\begin{array}{r} 1249 \\ 371 \\ \hline 1249 \\ 8743\cdot \\ 3747\cdot\cdot \\ \hline \end{array}$$

This method of setting-out has the disadvantage that the partial product of greatest significance is dealt with last. When the pupil reaches a more advanced stage, and begins to learn to do 'approximation,' methods of calculation, this order of working must be exactly reversed. Hence if the first habit has been thoroughly practised in the elementary stages of instruction, there will be a temporary cessation of improvement in calculation when it is necessary to learn the 'approximation' habits. The two sets of habits conflict.

This brief survey of learning-curves gives some useful hints for teaching-practice. Children must be habituated in certain fundamental skills, such as reading, writing, transcribing, arithmetical computation. Our aim should be to conduct the learning so that the pupils' progress is:

As rapid as his mental and physical capacity will permit.
Free from reversals of progress.
Free from plateau-periods.

To secure these results we must keep in mind the two sets of factors, external and inherent. To control the first we can do the following:

Make the classroom conditions bright and cheerful, and as hygienic as circumstances permit.
Avoid fatigue due to too prolonged practice at each sitting.
Remove distractions.
Keep the pupils' motives strong and persistent by a judicious organization of incentives.

Suggestion 4 has already been dealt with in detail in Chapter V. Particular attention should be given to the setting of *as high a standard of attainment* as the pupils' powers permit; to informing pupils clearly and regularly about the results of their practice; and to the prescription of definite achievements to be aimed at in each practice.[1]

To control the factors inherent in the learning-process itself we must carry out the following procedures:

1. Practise partial habits in the way they will be required at a later phase of learning.

Children do not require multiplication tables *en bloc*, but only specific items. If a pupil learns a table in serial order—one two is two, two twos are four, three twos are six, and so on, he may find it very difficult to say what seven twos amount to, without beginning at the first line and repeating the series until the item 'seven twos' is reached. Therefore as soon as a multiplication table has been demonstrated, and its 'build' understood by the pupils, they should be practised, not in memorizing the table as a whole in serial form, but in memorizing the separate items in haphazard order (or disorder !), as they will have to use the table in practice.

Similarly, it is better to teach the process of multiplication in a form favourable to the 'approximation' phase, from the very first lessons. Thus, instead of using the setting described on p. 291, we should use this alternative:

$$1249 \times 371$$

$$\begin{array}{r} 1249 \\ 371 \\ \hline 3747\cdot\cdot \\ 8743\cdot \\ 1249 \\ \hline \end{array}$$

beginning to multiply with the digit of highest place value.

In all elementary teaching we should keep in view not only the immediate future, but also the requirements of the ultimate stages of skill. A well-taught pupil *will have as little as possible to unlearn* at a later date.

2. Wherever possible aim at practising the complex co-ordina-

[1] *Cf.* p. 128. It is interesting to note that the curve of improvement in arithmetical addition obtained by Mace (Fig. 16) in which there is no plateau, and an almost complete absence of reversals, was obtained with boys of 11½ years of age (on the average) using the method of prescribing a moving standard of achievement.

tion of habits from the commencement of learning rather than at perfecting one partial habit at a time.

In teaching young children to transcribe, encourage them from the very beginning to look at a word or a phrase, as a whole, and then transcribe it from memory. Discourage the natural tendency to copy one letter, or one word, at a time. Similarly in teaching typewriting, modern instructors require their pupils to practise typing from the copy as soon as they begin to practise. Looking at the copy and then finding the keys by looking at the keyboard is discouraged. The first alternative may be more difficult at first, but it produces a much greater skill later.

If, as often happens, some particular phase of the process presents special difficulties, this will have to receive special attention and special practice. This special practice, however, is best undertaken *after* the learner has been able to get a *general view of the whole process.* Then, the *need* for the special practice is more apparent. In addition, the connexion between the particular phase receiving attention, and the whole pattern of the skill, is clear. The general outline of the whole process should be grasped *first* before any partial habits are intensively practised.

In all sensory-motor learning a good *demonstration* of the skill habits to be acquired is most important. Demonstration is much superior to verbal instruction. The learner must have in view as clear as possible a picture of the skill to be acquired from the commencement of the practice.

Some Conditions of Effective Practice

A great deal of experimental work has been done to discover the most effective conditions for habituation. The following sections deal with some of the results particularly relevant to normal school-practice.

OVER-LEARNING

If thorough mastery of subject-matter or of skill and long retention are desired, the learning-process must be continued *well beyond the critical point at which the material learned can just be recalled, or the task just accomplished with effort.* In the early stages of learning there is usually a lack of confidence and a feeling of insecurity. The material to be remembered seems to be just beyond recall, and the task just too difficult to perform. If the learning is continued, the feeling of insecurity begins to give place

to a feeling of mastery. Practice must be carried on beyond this stage, until the performance can be accomplished with a minimum of effort. Carrying on the learning-process well beyond the critical stage of bare achievement is known as over-learning.

ACTIVE LEARNING 'VERSUS' PASSIVE REPETITION

Learning will be most effective when the learner adopts an active attitude towards the process.

This principle is very well exemplified in the conduct of memory-investigations. Suppose we wish to find out how many repetitions are needed to commit a poem to memory. The investigator can collect his subjects together, and read the poem through while they listen. If a number of groups take part in the experiments he may read the same passage several hundred times. It often happens that although the investigator may be a better memorizer than his subjects he is unable to repeat correctly what he has read many times, while the subjects require only a comparatively few repetitions.

The investigator is not required to recall correctly what he has read. Therefore he is not interested in the attempts to recall. His listeners, on the other hand, will be trying very hard to memorize.

This active attitude will be guaranteed by interest in the material, and interest in the learning-process. It may be encouraged deliberately by requiring the learner to try to reproduce, without the aid of the copy, as early as possible in the learning-process. For example, in learning a poem, after it has been read through a few times 'to get the hang of it,' one should discard the copy and attempt to repeat from memory. As soon as memory fails glance at the copy again to pick up the correct clue, then proceed without the copy. When teaching children tables, geometrical or other proofs, formulæ, etc., let them *apply* the material as soon as they have grasped the general outline of the connexions.

Passive repetition carried on with an attitude of indifference or boredom is very inefficient and every endeavour should be made to avoid it.

WHAT IS THE BEST LENGTH FOR A LEARNING-PERIOD

By a learning-period is meant any period of time during which the learning is carried on continuously.

Economical learning requires active interest and effort. Boredom and fatigue prevent effort. Hence learning-periods should be stopped *before* the onset of boredom and fatigue. For concentrated learning, short periods are indicated.

The periods should not be too short, however. Measurements of output have proved that normal learning-periods have three phases :

(i) *A 'warming-up' phase*

The learner usually begins slowly and requires some little time to "get into the swing" of the task.

(ii) *A phase of full output*

Having got a good working 'swing' the learner continues for some time at his best, until he arrives at

(iii) *A slowing-down phase*

This begins with the onset of fatigue or boredom. Output diminishes slowly at first then more rapidly. If a definite task must be completed, or a definite period has been allotted for the learning, there is usually a spurt when the end is in sight.

Represented graphically, the output curve is somewhat like this :

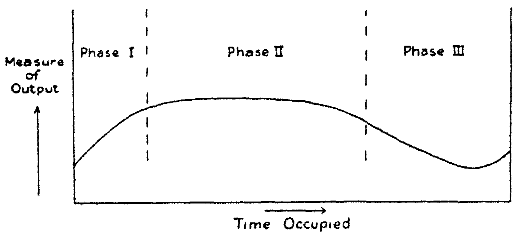

FIG. 17

Hence, if the working-period is to be filled most economically, phase II must be as long as possible in comparison with phases I and III. If the periods are made too short the working-time is finished before phase II runs its full course, or, in extreme cases, before it has really begun.

For senior pupils and adults the best length for a learning-period is about thirty-five to forty minutes. This is an average time and will vary according to the individual learner's power of concentration and endurance, and the nature of the task to be learned. The more difficult the material the shorter[1] should be the learning-period. Shorter periods are necessary for younger pupils, since they are more easily fatigued.

[1] Within limits suggested by the output-curve.

THE DISTRIBUTION OF LEARNING-PERIODS

Another problem in economical learning relates to the frequency with which we ought to practise. Is it better to 'mass' the learning-periods close together with only short intervals between them, or is it better to space them out by allowing a greater interval between successive practices?

In this connexion we must first note some further characteristics of the learning-process:

(*a*) First impressions are rapidly forgotten and need early and frequent revision. (*Cf.* p. 278).

(*b*) Retroactive inhibition.

This is the name given to the interference caused by intense mental effort exerted *immediately after* a learning-period has been completed. The effect of the interference is indicated by the following experiment.

A group of learners is tested for memory-capacity and learning-ability. The group is divided into two sub-groups of equal average ability. Both sub-groups are required to memorize the same material such as prose, poetry, or tables. At the end of a given time the learning is stopped. Sub-group *A* is required to commence immediately, some further intellectual work demanding close attention. Sub-group *B* is allowed a complete rest. At the end of this second period both sub-groups are required to reproduce as much as possible of the material first learned.

It is found invariably that sub-group *B*, the members of which have been rested after the learning, can reproduce more than the members of sub-group *A*. The further period of intellectual effort undertaken by the latter interferes with the previous learning.

Experimental tests indicate that the maximum amount of retroactive inhibition is produced when the second activity is very similar in form to the first.[1]

This inhibition is undoubtedly one factor in reducing the efficiency of a learner who extends his learning-periods over too long a time. After an optimum period (which is probably from thirty-five to forty minutes for the average adult) the effect of continuing the effort to learn is equivalent to taking up another similar kind of intense intellectual work. What is attempted in the later portion of the long learning-period not only adds nothing of value *but positively cancels out part of what has already been accomplished.*

[1] See T. G. Foran, "Retro-active Inhibition," *Journal of Educational Psychology*, Vol. XXVIII, September 1937, p. 460.

It should be an invariable rule, particularly with children, that after they have been occupied in concentrated learning they should either (i) have an opportunity for complete relaxation, or (ii) take up another kind of occupation which is *different in form from what they have been doing, and easy to accomplish.*

REMINISCENCE

It has been shown by Ballard [1] that the effect of lapse of time is not a simple one-way loss of what has been learned. While there is a loss of some items, *other items are actually recovered* after a lapse of time.

A class of schoolboys was given thirteen minutes in which to memorize the poem, "The Loss of the Royal George." At the end of this period they were required to write down as much as they could remember of the poem. The precaution was taken to exclude from the experiment any boys who were at all familiar with the piece. Of the remainder, *one* boy wrote down all of the 36 lines, the average for the class being 27·6 lines.

After an interval of two days, during which no opportunity for revision was allowed, Ballard gave the same class a second, *unexpected* test and obtained a rather striking result. *Eight* boys wrote out the whole poem of 36 lines, and the class average rose to 30·6 lines, an increase of rather more than 10 per cent.

This result was confirmed by further experiments on subjects of varying ages. In addition the investigator found that:

The more comprehensible and interesting the material learned, the greater the reminiscence.

Some reminiscence occurred even with nonsense-material.

The younger the pupils the more marked was the reminiscence.

There were considerable individual differences with respect to the power of reminiscence.

The process appears to be most active *in the case of the older and better established associations of ideas.*

The most favourable interval for maximum reminiscence is about two days.

Ballard considered that the most satisfactory way of accounting for this interesting phenomenon was to suppose that the initial learning-process stimulated growth in the actual nervous system of the learner, and that this increased growth, once stimulated, continued under its own momentum (so to speak) for some time after active learning ceased.

[1] "Obliviscence and Reminiscence," *British Journal of Psychology,* Monograph Supplement, Vol. I, No. 2.

Consideration of the phenomena of retroactive inhibition and reminiscence seems to suggest that there should be a definite advantage in spacing out (or distributing) learning-periods. This rule is now generally accepted. Two learning-periods of fifteen minutes each, one in the morning, one in the afternoon, are more effective than one period of thirty minutes. Starch has shown [1] that for a total period of 120 minutes of practice in substituting numbers for letters according to a key, the greatest progress was made by a group of learners doing two ten-minute practices each day for six days. A group doing one twenty-minute practice per day for six days did less well, and the worst result was shown by a group doing 120 minutes' continuous practice.

However, the general rule that spaced practice is most effective needs some qualifications of which the following are important:

(i) There must be obviously a lower limit beyond which it is not economical to sub-divide the learning-periods. (*Cf.* p. 295).

(ii) In view of the very rapid disappearance of nonsense-material, and of items of information with a minimum of logical connexion, such as dates in history; geographical data; vocabularies; it seems desirable in those cases *to revise frequently at short intervals as soon as possible after the initial learning.* When the pupils approach the condition of over-learning, the successive practices or revision periods can be spaced out at rapidly increasing intervals.

(iii) In the acquisition of skill it is essential for success that the pupil shall *acquire correct and economical habits as soon as possible* in the learning-process. If bad habits acquired in early practices are repeated they will persist at the expense of more efficient habits, and they will need much time and care to eradicate them. Therefore, it is often advantageous in learning skills, to 'mass' the practice-periods at the beginning of the learning until the pupil has acquired some degree of proficiency in the correct habits. After that, the learning-periods may be spaced out.

(iv) In acquiring complicated skills it is difficult for a learner to make much progress until (*a*) he has discovered a general principle of procedure (in other words, has found the 'knack' of it), and (*b*) has established a good rhythm of operation (*i.e.*, has got into a good 'swing'). The sooner these two results are attained, the sooner will the learner make good progress. Hence in learning complicated skills there may be a definite advantage in 'massing' together the practices in the early part of the course.

[1] *Journal of Educational Psychology*, Vol. 3, 1912.

CRAMMING

By ' cramming ' we mean what may be called brute memorizing by means of prolonged and concentrated effort. Cramming is to a learner what forced marches are to an army. The question arises, does cramming ever pay? The answer depends on our purpose in learning. There are two alternatives.

1. We may try to learn a set task with the *fewest possible number of repetitions*, and learn it with the *intention of remembering it for the longest possible time.* If this is our purpose then *spaced* learning is by far the more advantageous process.

2. We may be obliged to memorize information in the *shortest possible time*, for use on one particular occasion *after which we shall not need to recall the information again.* A student may be required to pass an elementary test in Latin, not because he is interested in it, nor because he will require the knowledge later, but because an examination syllabus prescribes it. For this purpose concentrated practice is often necessary on account of the time-limit imposed.

For general teaching-purposes when the material is valuable and likely to be needed for a long time, cramming should be avoided. It is very fatiguing, arouses strong aversion for the subject-matter, and what is learned in this way is soon forgotten.

WHOLE *v.* PART LEARNING

There has been a good deal of controversy about the advisability of learning a poem (*a*) by repeating a large portion of it as a whole each time, or (*b*) by repeating it a line at a time. In many schools formerly, pupils learning a hymn would say the first line over and over again until they knew it by heart. Then they would treat the second line in the same way, and so on to the end of the first verse. Then the verse would be repeated as a whole.

The disadvantages of such a procedure are obvious. In the first place, what may be an interesting piece of poetry with a thread of meaning running clearly through it is broken up into a large number of comparatively meaningless phrases. The superior memory-value of the logical associations is thus destroyed. Secondly, the mechanical associations are not learned in the form in which they must be reproduced. In normal use, the last word of any line must be associated with the first word of the *succeeding* line. By learning one separate line at a time, the last word of the line is associated with the first word of the *same* line in a continuous cycle

It was found by experiment that many subjects could learn a piece of continuous prose or poetry by heart much more economically by the 'whole' method, and this has been advocated as the best method for learning in all cases.

This statement needs qualification, however. It has been shown by Pechstein [1] and Gopalaswami [2] that for learning complicated motor associations, such as running a maze, or mirror drawing, what is called "a progressive-part method" is more economical than either the whole or part methods. This was found to be true both for rats and human beings in learning to run a complicated maze, and for human beings in learning nonsense-material.

The progressive-part method consists in dividing up the task to be learned into several short portions. The learner masters the first portion thoroughly. Then he masters the second portion. Next he *repeats portions one and two together until they have been learned as a whole.* The third portion is then mastered, followed by the repetition of portions one, two, and three together. This progressive method is followed until the whole task has been accomplished successfully. This method is the more advantageous the more difficult the material to be learned. (*Cf.* recapitulation, p. 281).

THE 'MIXED' METHOD OF LEARNING

The whole method of learning makes it possible to use any logical sequence or 'plot' to advantage. However, even with logical material it is found that some portions are more easily mastered than others. We usually find what are called 'refractory associations.' If we adopt the whole method and continue to repeat the piece from beginning to end until we have mastered it, it is obvious that we shall repeat the easy associations as often as the refractory associations. This is a waste of time. Therefore a 'mixed' method is best. The following procedure is recommended for *logically connected* material.

Read through the whole piece, noting the plot, the sequence of events, and the connexions involved.

Repeat this several times until the material as a whole begins to feel familiar.

Turn the copy over, and attempt to recall it actively, prompting

[1] *Psychological Monographs*, 1917, No. XXIII; *Journal of Educational Psychology*, 1918, No. IX.

[2] *British Journal of Psychology*, Vol. 15, 1924–5.

at each hesitation by referring to the copy. Active recall is always better than passive repetition, and, by prompting at each hesitation *we avoid repeating errors.* This active recall also indicates what are the refractory associations. Having noted these, concentrate upon each in turn, practising it until thoroughly mastered. Then connect it with its immediate context.

Read through the piece as a whole and repeat until mastery has been achieved.

C. Manner of Presentation in Relation to Long Retention and Effective Recall

We may summarize the discussion so far by stating three fundamental conditions for long retention and effective recall. These are (*a*) Motivation, (*b*) Frequency, (*c*) Recency.

Motivation

Other things being equal, the greater the zest for learning, and the more definite the intention to remember, the longer are we likely to retain the effects of an experience and the more readily can we recall it.

The principles of motivation have been discussed in Section II, which should be revised in connexion with the present chapter.

Frequency

Other things being equal, the more frequently an experience has been repeated, the longer will its effects be retained and the more readily will it be recalled.

Recency

Other things being equal, the more recent the experience the more readily will it be recalled.

Recapitulation ensures recency of experience; revision and repetitive practice ensure frequency of the experience. The best conditions for recapitulation, revision, and repetitive practice have been indicated in the present chapter.

To these three conditions we must now add a fourth:

Vividness and Impressiveness of Stimulation

Other things being equal, the more vivid and impressive the experience the longer is it likely to be retained and the more readily recalled.

In school-practice, vividness and impressiveness of stimulation can be enhanced by the manner in which the material to be learned is presented to the pupils. The most important conditions which favour vividness and impressiveness are as follows:

1. Stimuli must be clear, adequate, and free from distraction.

Therefore attend to lighting and accoustic conditions (*e.g.*, use clear deliberate speech loud enough to be heard comfortably by all pupils and free from distracting noises).

Maps, pictures, diagrams, models should be large enough to be seen easily and free from unnecessary detail.

2. Mild stimuli may need several repetitions before they are fully noted.

3. Impressiveness of stimulation is increased by using several correlated sense-organs at the same time.

Material should be presented in such a way that as many sense-organs as possible are stimulated together. Vision, motor-speech, practical manipulation must be used to reinforce aural impressions. For most children visual and motor stimuli are more vivid than aural stimuli.

Hence :

Use colours to emphasize distinctions.
Use pictures and models to reinforce oral description.
Use demonstrations rather than oral description in introducing *processes*.
Note importance of moving pictures and working models.
Use the blackboard to reinforce oral exposition.
Note the importance of graphical devices for presenting relations.

Graphical devices are particularly useful for representing comparative statistics in economics, geography, history, science, etc. Compare the vividness of the output-diagram with that of the verbal description of variations of output in the course of a learning-period (p. 295).

In this connexion note the fact that the cinema can be used for presenting not only moving pictures but also *moving maps, charts, and diagrams, e.g.*, the successive phases of an invasion or growth of an institution ; variations in volume of imports and exports, etc. In other words, the cinema film and screen can be used to develop a moving blackboard.

Examples of devices for using several co-ordinated sense-organs are :

Writing a new word on the blackboard, pronouncing it for the pupils, requiring pupils to pronounce it aloud, requiring them to write it down.
Allowing pupils to repeat material to be memorized, aloud, with appropriate gestures.

Dramatizing historical and literary scenes.

Using manipulative methods in the teaching of arithmetic and science.

Note in this connexion the Exeter experiment (p. 44), and Ballard's experiments in teaching fractions (p. 43).

4. Grouped data are more impressive than isolated data. In presentation, data may be grouped:

By close spatial proximity.

According to similarity.

By logical association, either in a series or a system.

By artificial devices, such as mnemonics or rhyming verses.

In presenting any factual details, such as occur frequently in history, economics, geography, language, it is desirable to group associated data together, and emphasize logical relations between them. Make secondary associations whenever possible and, in doing so, associate new material with *old, familiar, and well-established knowledge.*

Emphasize in the pupils the attitude of seeking for relations, and grouping data in systematic summaries.

Where a series of arbitrary details must be learned, mnemonic devices are sometimes useful. Years ago the writer had to learn by heart the battles of the Wars of the Roses. The following mnemonic was suggested: All Boys Never Will Mention All Those Hateful, Horrid Battles To Bosworth. Here the initials are also the initials of the names of the battles in question, namely, St Albans, Bloreheath, Northampton, Wakefield, Mortimer's Cross, St Albans, Towton, Hedgeley Moor, Hexham, Barnet, Tewkesbury, Bosworth.

The mnemonic has some recognizable logical form and is much easier to retain than the list of names.

5. Experiences may be made more impressive by arousing interest in them. The pupils are then more alert, attention adjustments more quickly made and more effective.

In this connexion note particularly:

(i) Emphasis on the value and use of the material to be learned.

Material which serves a felt need, and the purpose of which is clearly recognized, will be the more readily apprehended and retained (*cf.* discussions on motivation, Chapter V).

(ii) Preparation of an expectant attitude in the pupils.

A reasonable amount of what may be called 'showmanship' is valuable in teaching. Its purpose is to increase the attractiveness of the presented material, to 'intrigue' the pupils and arouse an expectant attitude.

Compare the attractive value of the following procedures for presenting the fact that chlorine gas is a bleaching agent:

Instructing pupils to read a statement of the fact.

Stating the fact orally to the pupils.

Merely showing an experiment to demonstrate the fact.

Showing an experiment in the following way:

The teacher takes a jar of chlorine gas, and mentions that the gas will act as a bleaching agent.

He then takes a sheet of paper and writes on it in *ink*, "Form III boys are clever." Underneath this he writes in *pencil*, "Form III boys are not clever."

The sheet of paper is shown to the class with the suggestion that the jar of chlorine gas will act as an oracle and deliver judgment. The paper is then dipped into the gas.

The ink marks are rapidly bleached and disappear, leaving the pencil marks still showing clearly.

In a case like this the presentation not only arouses a strong expectant attitude in the class, but it also intrigues them and the pupils will discuss it later, spontaneously. This ensures recall and repetition in imagery.

Further, the experiment is so arranged that the result leads directly to a discussion about the reason why the ink marks and not the pencil marks are bleached, and thence to an inquiry into the conditions in which chlorine acts as a bleaching agent.

D. Teaching Pupils how to Study *

Generally speaking, very little attention has been given in schools to the need for teaching pupils how to study. Without expert guidance few individuals succeed in realizing their full learning-powers. Much time and energy are wasted daily by university students for the simple reason that no instruction in methods of economical learning and study has been given to them in their secondary-school careers. Sufficient is now known about the best conditions for learning, to enable any teacher to organize his work and guide the learning-habits of his pupils efficiently. If only a fraction of the knowledge available were systematically applied a very considerable improvement in teaching and learning would be gained. It is even more important that as pupils approach the senior stages of school-life, the more obvious rules of economical learning should be explained to them as occasions arise, and these methods *made explicitly conscious*. If the adolescent is interested in his mental processes and their conditions he will be the better able to carry on his own further education when he leaves the tutelage of his school.

From replies to questions, one gathers that the secondary-school tuition of some students has consisted to a great extent of verbal exposition in the form of a lecture by the teacher, followed by hurried dictation of notes. The pupils contribute little or nothing to this process beyond passive listening and bad writing. When such students pass into university institutions where some degree of independent work is expected, they are helpless. Their one aim in life is to make verbatim copies of lectures or books and then hurry off to memorize their notes. This condition of affairs is by no means limited to one country. In their *Elementary Principles of Education*, Thorndike and Gates assert that "it requires considerable time and much guidance to develop skill in learning from books. Many university students of the present generation have amazingly little skill." [1]

As books multiply, and find their way in increasing numbers into all types of schools, and as more importance is given to 'individual' methods of school-organization, the more is it necessary to train pupils in the art of reading. The following habits intelligently used will make reading more profitable:

Read the book (or article) through rapidly at first to get a conspectus of the general plan, the main and subsidiary problems treated, and the author's point of view.

Review the first reading from memory and endeavour to reconstruct the general lay-out of the argument, putting the topics treated in some order of importance.

Read subsequently *with definite problems in mind* for which answers are sought.

Endeavour to separate main principles of importance from illustrative material and subsidiary detail.

Associate the facts learned with other facts already known.

Compare what is read with material gathered from other sources. Make definite references from one book to another and from the book to personal practical experience.

Recapitulate frequently what has been read, and actively relate it to the present reading.

Think out possible ways in which the information gathered can be applied.

Test the assertions of the book by reference to specific facts in the reader's own experience. If a text-book on educational psychology asserts that the average child behaves in such and

[1] Book cited, p. 244. The authors have American students in mind.

such a way, think of some normal children in actual life and endeavour to find out how far the assertion is true in their particular cases.

Make short summaries of main principles for convenient reference and revision later.

Pupils in secondary schools need practice in making *their own notes and summaries* both from verbal exposition and from books. From an *educational* point of view the dictation of notes by the teacher is a veritable plague and should be avoided as such. Only in cases where some formula or statement must be learned in precise language should the practice of dictating be used. Pupils who are inured to dictation soon fall into the habit of ignoring the preliminary lecture, knowing full well that in due course they will be able to copy down just what information they are expected to learn. To pay any attention to the exposition is clearly superfluous, in their opinion.

E. Fatigue

Fatigue is an important factor in causing loss of efficiency in learning. Psychologically it consists first in feeling a loss of interest in, then aversion to, the activity being performed, accompanied by desire for change. If the worker persists in the activity, definite localized, organic sensations arise. Headache, aching of the limbs, and in extreme cases pain on movement are felt. When very tired we feel an intolerable aversion for any further movement. In extreme fatigue co-ordination both of thinking and muscular action fails. Ideas are disjointed and movements jerky.

In an earlier chapter it was suggested that successful activity depends upon the maintenance of certain internal constants. It is known that any nervous and muscular activity is accompanied by chemical changes in the tissues. The energy for the work is derived from the decomposition of complex, organic substances, and by-products are secreted into the blood as a result. The by-products include carbon dioxide, lactic acid, and toxins derived from the destruction of cells. Normally these are removed as fast as they are formed, fresh fuel and oxygen are supplied to the working parts and the cycle of physiological activity continues. It would seem that the physiological causes of fatigue are mainly (*a*) the excessive production of toxic substances faster than they can be removed, and (*b*) lack of fresh fuel and oxygen necessary for rebuilding the exhausted tissue. It is well known that after

illness, during malnutrition or oxygen deprivation, fatigue sets in very quickly, and the amount of work possible is small.[1]

It seems desirable to note a distinction between *local* and *general* fatigue. In writing, for example, the muscles immediately involved begin to tire and the act of writing becomes painful. One turns from writing to general movement such as walking or playing tennis, with relief, and the local fatigue passes away. Probably the increased general circulation helps to remove the local physiological conditions of fatigue. Similarly, one turns from continued study of one kind of subject-matter to a different kind with a renewal of interest and vigour. In such cases a change of occupation is equivalent to a rest.

Native, or old-established habitual activities are less easily fatigued than newly acquired habits. For this reason, practice-periods in all *new* skills should be short, particularly for young children.

There seems no reason to distinguish between mental and muscular fatigue. Both appear to be due to similar physiological causes. Provided that the fatigue is not excessive we can turn with interest and pleasure from mental work to muscular activity because the fatigue is local. However, if the fatigue is excessive, whether mental or muscular, it spreads throughout the system, and if we are thoroughly tired we cannot do any more work efficiently whether physical or mental. People who are thoroughly tired after an examination for example, do not perform muscular activity with either efficiency or pleasure. This is important, for it is sometimes assumed that excessive demands for physical activity may be made upon children without reference to their mental work and *vice versa.*

When fatigue becomes general, the only effective remedy is complete rest and sleep.

If continuous work is required, then care should be taken to *adjust the rate of work so that it is well within the worker's capacity*, and periods of relaxation must be allowed between periods of strenuous activity. It is probable that both adults and children adjust themselves more or less automatically to an *optimum* rate of work. This optimum rate represents a condition in which the energy output is approximately equal to the input of fuel and rate of restoration. In walking, for example, the body adjusts itself to a comfortable pace at which walking is a pleasure. At this pace the walking can be kept up for a long time. If the pace

[1] See A. V. Hill, *Living Machinery*, Chapter II.

is faster than this, fatigue sets in rapidly and although it appears that a better result is obtained at first, the final result is less than if the pace had been favourable. At the optimum rate of walking, there is time for short periods of relaxation between the instants of intensive effort. What applies to walking, applies equally well to mental work. Over-driving at school gives the appearance of rapid progress, but the pace cannot be maintained without damage to the pupils. Teachers should aim at an *optimum* rate of progress, *not the fastest rate* at which they can drive the pupils to work.[1]

Note that interest diminishes fatigue. Interest may be considered as a sign that energy is being freely supplied.

Also, children show great differences in fatiguability. Some tire much more quickly than others. Allowance needs to be made for this.

Conflict of motive, worry, anxiety are all powerful causes of fatigue.

DAILY VARIATIONS IN EFFICIENCY

Experiments have shown that efficiency of work varies fairly regularly during the course of the day. Beginning at 9.0 A.M. the rate of work tends to rise to a maximum between 10 A.M. and 11 A.M., then decreases to a minimum between 1 P.M. and 2 P.M. Thereafter follows a second rise in efficiency till about 3 P.M., followed by another decline. The differences are not great, but sufficient to be worth noting. Hence it is desirable to arrange the most difficult work during the second part of the morning session. Any tests requiring concentration may be assigned to this period. Routine exercises may be undertaken at the beginning of the afternoon session, while games may profitably be taken during the last afternoon periods.

In making time-tables attention must be paid to the need for sufficient change of occupation, and the inclusion of rest-pauses.

BOOKS FOR FURTHER REFERENCE

PYLE: *The Psychology of Learning.*
MACE: *The Psychology of Study.*
STILLMAN: *Training Children to Study.*
WATT: *Economy and Training of Memory.*
BOOK: *Economy and Technique of Learning.*
JONES: *Introduction to the Theory and Practice of Psychology.*
THORNDIKE: *Educational Psychology*, Vols. II and III.
VALENTINE: *Introduction to Experimental Psychology in Relation to Education.*

[1] Hill, book cited, Chapter VI.

SECTION V

THE PRACTICE OF INSTRUCTION

CHAPTER XI

THE PRACTICE OF INSTRUCTION

A. PRESENTATION, GUIDANCE, DIAGNOSIS OF DIFFICULTIES, AND LESSON-DEVELOPMENT

I. SOME PRELIMINARY CONSIDERATIONS

This chapter is intended primarily for students-in-training who have had but little actual practice in teaching.

The most effective methods of teaching can be inferred from the principles of motivation and of intellectual development already discussed. However, it is one thing to have a theoretical knowledge of mental development, yet quite another to be able to apply the principles in the very varying conditions in which teachers may have to practise. In this chapter therefore we shall consider two main problems: (*a*) the organization of a unit of work; and (*b*) the variations which must be made in order to do justice to different types of subject-matter.

THE PRACTICAL TEACHING-SITUATION

We will suppose now that we are confronted by a class, in size somewhere between twenty-five and forty pupils. In general, the pupils may vary in age from about five up to about eighteen years, but we shall assume that we have a reasonably homogeneous class, and that the pupils are at the post-primary stage of schooling. The principles we have discussed hitherto are general in their application and cover all phases of education. Nevertheless, differences in organization are required for different age-groups.

In the five-to-eight year age-groups the teaching needs to be informal, giving opportunity for plenty of free movement and play-activity.

The characteristic emphasis in this period is upon first-hand experience of the environment; development of sense-perception;

and of the fundamental tools of learning, namely, the motor habits, first of speech, and later of reading and writing.

In the eight-to-eleven year age-groups, while the organization should still allow as much as possible of free movement, the emphasis becomes more matter-of-fact and realistic. The pupils continue their first-hand contact with the environment and extend it over a wider area on account of their greater strength and physical independence. At the same time they can supplement this experience by information gained through reading. This is the period for perfecting the habits of speech, reading, and writing, and using them in the extension of the pupil's intellectual universe. Towards the end of this period comes a gradual transition to more formal studies, *e.g.*, the first rudiments of grammar, and mathematical work (including elementary mathematical concepts in physical geography and surveying, *e.g.*, position, time-measurement).

In the eleven-plus period, again without any abrupt change, the characteristic emphasis passes to the more formal, abstract, and systematic aspects of learning. The pupil keeps on gathering more first-hand experience. His intellect increases in breadth, but the facts are now seen to be related by general principles in the systematic branches of knowledge we call subjects. This is the time when full abstraction approaches, and when the interrelatedness of experience makes possible more efficient observation and reasoning. The intellect increases correspondingly in depth and subtlety.

It is with this senior or post-primary period that we shall deal in detail here.

In addition to our class, we shall have some more or less definite syllabus of work to cover, possibly in one year only, but more frequently in a period of four or six years. Our practical task is to *introduce this syllabus to the pupils* in such a way that they *assimilate* it and it is incorporated within their mental and physical development in the form of *living knowledge and skill.*

Working by the light of nature, so to speak, in the absence of any definite professional training, we may adopt two extreme ways of organizing the teaching. We may call these the *recitation* plan, and the *heuristic* plan. The former is usually the choice of the pedants; the latter of the originators—artists, scientists, literary creators, and craftsmen.

In the recitation plan the pupils repeat a form of words after the teacher, or read one from a book, until they have memorized it 'by heart.' Then they re-cite it to the teacher who checks it from his own memory or from the book. Whether or no the pupils *understand* the significance of the form of words is not a matter of

great consequence. The plan may be modified into a catechism, the teacher asking questions and the pupils responding with the appropriate form of words.

The extreme form of this plan produces intellectual death through suffocation. The pupils' mental activity is smothered in a heap of words. (*Cf.* p. 156).

The heuristic plan goes to an opposite extreme. The pupil is put into a laboratory or a workshop and given some apparatus and tools ; or he is presented with a copy of Virgil and Plato in the original classics. Thereupon he is told to teach himself. Alternatively, according to a more modern version of the plan, he is encouraged to roam at will and pick up what information and skill he may, at any time, and in any way that happens to suit him at that moment.

In the case of a young genius this plan may succeed and produce striking results. However, such geniuses are relatively rare, and the usual result is intellectual anæmia and malnutrition. A good hearty meal of steak and chips with a pint of ale may be excellent for a robust adult, but it merely makes a baby sick, and he will starve on such a diet, if it is continued.

Somehow we must steer a common-sense, middle course between these two extremes. This the scholarly and efficient teacher can do because he knows both the subject-matter *and the pupils* and he can *adapt the subject-matter to their needs.*

It is this process of adaptation that we shall attempt to indicate in detail.

Most beginners in teaching are obsessed with the subject-matter and forget the pupils, and the higher their academic honours the more complete seems to be the forgetting. We would invite readers for the moment to forget their academic specialized subject-matter and concentrate upon the pupils.

IMPORTANCE OF CLEAR AIMS IN TEACHING

The first consideration in approaching our class must be—*what aims do we expect to achieve by the teaching?* From the point of view of *intellectual* development our general aims should be :

Clear grasp by the pupils of significant knowledge (characters and relations).

Skilful habits of work.

Interest and satisfaction in the possession of knowledge and skill.

Ability to use the knowledge and apply the skill—that is intelligent adaptation through transfer.
High standards of aspiration.

IMPORTANCE OF EFFECTIVE CONTACT BETWEEN TEACHER AND PUPILS

Having set himself a clear aim, the teacher's next task must be to establish a *vital personal contact* with his pupils. This contact has two aspects :

Social

The social aspect of contact implies the existence of a *community of feeling and interest* between teacher and pupils.

On the part of the pupils there must be sentiments of respect and admiration for the teacher's knowledge, skill, personal integrity, and standards of conduct. Some degree of self-abasement is essential in the pupils. They must have the attitude of disciples towards a master (or mistress) or they will not be willing to learn. This attitude is not servility but reasonable acceptance. It is essential on account of the spread of interest and aversion by conditioning. The pupil's feeling-tones and emotional moods transfer from the teacher to what he teaches.

On the part of the teacher there must be sympathy, *courtesy*, patience, kindly encouragement, and an *interest in each individual pupil*. The pupils must be treated as persons and their personalities respected. This does not exclude firmness when it is indicated. Pupils prefer firmness tempered with justice to an easy, slovenly familiarity. They prefer their teacher to be dignified.

This social aspect of the contact is the foundation for good motivation. It inspires in the pupils the will to work before they are capable of full voluntary control.

Intellectual

The teacher must maintain effective *intellectual* contact with his pupils. This means that he must be aware of the following factors :

Their degree of maturity and general intelligence.
Their special aptitudes and interests.
Their mental background and intellectual difficulties.

This intellectual awareness marks the difference between the mere scholar, and the scholarly teacher. It requires a knowledge

of child-development; observation of individual pupils' responses; familiarity with the general cultural background of the school region, the immediate local environment, and each individual pupil's educational attainment.

Knowledge about the cultural background—rural or urban; English, Welsh, Scottish; prevailing religious beliefs, political prejudices, social attitudes—can be obtained by the teacher through his own contact with the school-region and the immediate local environment. Such knowledge is essential if the pupils' deep mental background is to be correctly estimated.

Educational attainment can be discovered by studying the syllabuses supposed to have been covered in previous years. There should be collaboration between the staffs of secondary and senior schools, and of the junior schools from which their pupils come. There is, even now, a great diversity in methods of teaching (*e.g.*, decimals) and unless this is taken into account by the post-primary teachers the disturbance in development consequent upon the change of schools will be unnecessarily lengthened and intensified. Specialist teachers ought also to know what their colleagues are doing in cognate subjects. English, Latin, and modern foreign languages; science, mathematics, domestic science, handicraft, gardening, physical geography; humanistic geography, history, economics and civics—each of these groups contains many common elements both of content and procedure. If the specialists in charge of each subject are not fully alive to the interrelations of their own with other cognate subjects, and to what their colleagues are actually doing at any given time, there is bound to be overlapping, unnecessary repetition, and, perhaps worst of all, confusion and lack of explicit awareness in the pupils' minds. Instead of realizing the fundamental connexions, the learners are aware only of isolated and often meaningless items. Thus transfer and adaptability are smothered.[1]

In addition to knowing the syllabuses already covered, the post-primary teachers should explore, systematically, the attainments of the new pupils by means of oral discussions, questions, and written tests. It is important to discover what the pupils do

[1] This lack of explicit awareness of the interrelatedness of subjects is the most disturbing feature of our present over-specialized, over-mechanized, examination-ridden epoch. Nor will conditions improve until professional teachers awake to their educational responsibilities and get a scholarly grasp of their own and cognate subjects before they try to teach them.

not know, or know only imperfectly, since new knowledge must be interpreted in terms of what is already known. Hence gaps and distortions in knowledge exercise a cumulative effect upon future intellectual development.

Such preliminary information about the pupils must be supplemented by *continual careful observation* of their activities, preferences, and responses. This intellectual contact cannot be maintained directly since thoughts are not usually, if at all, transmitted by telepathy. The teacher must *infer* the pupils' states of mind, and difficulties in understanding, from their responses, *particularly from their wrong responses*. By this systematic observation of right and wrong responses, both oral and written, it is possible to estimate with reasonable accuracy how fast to proceed with the syllabus, and what parts of it need to be repeated.

Hence, a golden rule in all teaching is—*observe the pupils*. Watch their reactions closely and attempt to infer what is going on ' inside their heads ' so to speak. This is every bit as important as exposition and use of teaching-devices.

ORDER IN PRESENTATION

Teachers may not be able to choose their own syllabus of work, but they are completely in control of the order in which the material to be studied shall be presented, *i.e.*, set forth for the attention of the pupils.

Good order in presentation is indicated by our analysis of intellectual development. Certain types of order were there revealed which we can summarize briefly :

The Natural Rhythm of Intellectual Progress

(*a*) Knowledge is based first of all upon the fundamental characters of things apprehended through first-hand contact of the sense-organs with the physical environment.

Therefore at any stage in intellectual development the first step must be the analysis by observation of these fundamental characters and the provision of a corresponding vocabulary.

(*b*) Founded upon this first-hand knowledge of characters is explicit awareness of their *relatedness*. This gives to the characters their significance.

We have noted how relations emerge into full explicit awareness. First come the lower-order relations between the characters them-

selves, then higher multiple-order relations of greater complexity and subtlety.

Hence we must build upon the lower orders of relations, introducing them first and then working out relations between relations.

Our order in presentation must be, therefore, first-hand experience, first-order relations, multiple-order relations, at each stage developing a vocabulary flexible enough to enable the intellectual advances to be described, stabilized, and applied.[1]

If the pupils have already had ample first-hand experience and have organized a certain degree of relatedness, we need not begin again at the beginning. We can use this knowledge as a foundation and proceed to build upon it.

This order of presentation is aptly summarized in some of the rules of order set out in former text-books on method, *e.g.*,

Begin with the concrete and proceed to the abstract.

Begin with the familiar and proceed to the unknown.

Begin with a broad general view of a topic as a whole and proceed to more and more detailed analysis.[1]

These rules of order hold good for literary, descriptive, and scientific material. We should not commence the study of grammar until the pupils have already acquired a vocabulary and some practical skill in description. We should not begin a study of literary criticism and prose or poetic styles until the pupils have a good working acquaintance with *actual works of literary art.* In the same way we should not begin the study of chemical formulæ and atoms until the pupils are acquainted at first hand with a variety of chemical substances and the ways in which they react with each other. In geography and history, how well the pupils will appreciate what happens on the other side of the earth, or what happened a thousand years ago, will depend upon how well they have grasped the significance of what they have observed in their own neighbourhood and generation.

We can summarize this natural rhythm of intellectual progress as follows :

Analysis leading to clearly apprehended and abstracted characters and simpler relations.

Synthesis leading through association to systematization and generalization.

By comparison, contrast, reflection, complex relations between relations are elaborated.

[1] *Cf.* Line's experimental results, p. 189–192.

Application or creation.

Systematized knowledge is applied to the solution of new problems or to the production of original work.

Like waves on the ocean, this rhythm reveals itself in various periods, short periods superimposed on longer periods. The whole of life is one long cycle: analysis in early youth, synthesis in adolescence, creation in the adult period. Shorter periods are revealed in each of the scientist's new investigations, the author's new novels, the artist's new pictures, or the craftsman's new inventions. For each new endeavour the material must be collected, analysed, reflected upon and systematized, then applied. Whatever the period, however, the same fundamental order is followed.

Within this general rhythm of intellectual progress certain details of order are important for good presentation. These are:

Order of Interpretation or Apperception

Each new presentation to be fully intelligible to the observer must be interpreted or apperceived in terms of already existing knowledge. Therefore we can test whether the order of our presentation of items of lesson material is satisfactory at each step in the development, by asking: *Is this new material, now to be presented, likely to be interpreted adequately and therefore to be intelligible to the pupils?* If this criterion is not fulfilled, then before that item is presented we must first *organize a place for it* in the pupils' intellectual system.

Thus it is useless to talk about lines of latitude and longitude, equator, axes of reference, and so on until the pupils are acquainted *at first hand* with the idea of locating the position of a given object by referring it to a fixed system of lines. This notion must first be worked out in detail in simple cases in the classroom before lines of latitude and longitude can be intelligible to the pupils.

Logical Order

In any exposition involving an argument a logical order must be obeyed, in addition to the order of interpretation.

The pupils must first be familiar with the characters and relations involved, so that the actual terms in the argument are intelligible. In addition, however, the exposition must present the various propositions in the argument so that *all the necessary antecedents (or premisses) are clearly presented before a conclusion is asked for.*

A logical argument is like a chain composed of links. All the links must be sound, and all must be present in the correct order, otherwise the chain is useless. In the same way a logical argument must proceed step by step. If one step is omitted, or if the steps are presented in a wrong order, the argument becomes unintelligible to the listeners.

ILLUSTRATION AND GUIDANCE

Before proceeding further we must make a careful note of two processes which should *pervade* the presentation. These are illustration and guidance.

Illustration

Good illustration will make intellectually dead presentations come to life. We have already discussed the value of substitute-experience, *e.g.*, models and pictures. We wish at this point to call attention to the value of *verbal illustrations* such as simple stories and analogies.

We have noted that many apparently different situations have the same underlying logical form. Hence, if the similarity in form becomes explicitly recognizable, the significance of a familiar example can be transferred by the learner to the interpretation and understanding of an abstract new situation.

The function of verbal illustration was most aptly used by Professor John Hilton in a recent lecture, to a lay audience, on 'Credit.' The speaker began by saying how elusive and complex the problem is, and to what a degree the real nature of credit has been obscured by controversial arguments and special pleading. He then went on to give the example of a small girl who was sent by her mother to the butcher's shop for a pound of the scrag end of neck of mutton "on the nod till Saturday." He proceeded to analyse this homely example, and showed that it expressed in a simple and accurate way all the essential factors and relations in this complex problem of credit.

This method of teaching, as well as aiding understanding, has another great advantage. It aids the memory and *stimulates self-activity in the learner.* Many of Professor Hilton's audience knew little of abstract economics and a text-book exposition would have conveyed nothing but technical terms devoid of significance. But everyone was perfectly familiar with "on the nod till Saturday." Now, whenever the topic of commercial credit is

mentioned, those listeners will immediately call to mind the homely illustration and *from it will proceed to work out anew* its implications, which can then be used as analogies with which to attack the much more complex problems of banking and state credits. Thus the good illustration gives the knowledge which is power.

Some of the most brilliant examples of the use of verbal illustrations in the English language are the well-known " Parables of the Kingdom " in the New Testament. There, a most abstruse and subtle system of relations implied in the phrase " the Kingdom of God " was brought out with special clarity, for the benefit of uneducated peasants and work-people, by the use of homely analogies taken from the immediate social environment with which they were all perfectly familiar. Apart from their spiritual significance, these parables are worth studying for their pedagogic value.

Note that the illumination given by a good illustration works in two ways. Not only does the homely illustration bring out clearly the implications of the abstract subject-matter studied, but the general principles contained therein illuminate the homely environment and give it a significance not before suspected by the learner.

Note also how the mastery produced by the good illustration enhances the interest of the subject-matter.

Hence, every teacher must regard a collection of good illustrative stories and analogies as an essential part of his professional stock-in-trade. This, again, emphasizes the need for a close study and intimate knowledge of the local environment of the pupils.

Guidance

The mere act of presentation is not sufficient for good teaching. We have seen how it is usual for even important characters and relations to remain implicit—buried in the material details of the situations presented. These characters and relations must be brought clearly to light by a process of analysis. This consists essentially in concentrating the mental activity upon the characters and relations in question.

Again, methods of procedure in thinking and in practical work may remain bound up in the material situations without being explicitly realized by the learners. (*Cf.* experiments of Woodrow, Cox, and Meredith).

How then can the pupils' alert mental activity be directed

specifically to the characters, relations, and procedures in question? This is the work of guidance.

It can be accomplished by such devices as:

- Pointing by the teacher.
- Instructions from the teacher to look, listen, point out, touch some particular item in the presented material.
- Instructions to compare and contrast specific items and say what is noted.
- Providing problems and organizing difficulties which have the effect of producing *mental arrest* in the pupils, thereby intensifying the conative factors in mental activity. (*Cf.* the Socratic dialogue.)
- Providing good standards of taste; models of workmanship; and methods of procedure.

This guidance is most frequently neglected by students-in-training.

II. ORGANIZING A UNIT OF WORK: LESSON-DEVELOPMENT

We can now turn to the practical task of organizing a unit of work, keeping in mind the considerations already noted about contact, order in presentation, illustration, and guidance.

It has been customary to think of teaching as giving lessons. This term 'lesson,' however, is misleading. In the first place a lesson is apt to be identified with a given time-table period, and it is assumed that the material presented and the pupil activities concerned must just fill a period of thirty-five or forty minutes and then cease. In the second place, a lesson has become identical in traditional schooling with a verbal exposition by the teacher.

Both these associations are purely accidental. A logical section of the syllabus may extend over only a part of one time-table period, or over a term's work.

Also, modern teaching-practice has veered away from the verbal exposition method of teaching. In the Dalton Plan, and the plan adopted by the Parents' National Educational Union,[1] the 'lessons' are not verbal expositions by the teachers but typewritten or printed assignments by which the pupils are directed to source-books and problems and thereby enabled to carry on their work by individual study. These two plans are rather like correspondence courses—the teachers write out directions for study and problems for solution, and the pupils return written answers.[2]

[1] Initiated by Miss Charlotte Mason.

[2] See Helen Parkhurst, *Education on the Dalton Plan.*

In another modern form of teaching-practice—the so-called Project Plan—the 'lessons' are problems to be solved, both theoretical and practical, by the co-operative work of teacher and pupils. The Project Plan lends itself particularly well to science-work, handicraft, practical geography, mensuration, and dramatic work in literature.[1]

Both these plans require drastic modification of the traditional time-table and do not admit of teaching in orthodox lessons. For this reason it is better to speak of organizing 'units of work' than of teaching lessons. However, the term 'lesson' is so familiar in educational literature and practice that we shall use it for convenience, it being understood that lesson means a unit of work, *i.e.*, a logical whole or thought-unit.

The practical arrangements fall into three sections:

An introductory section.
The main body of the unit.
A rounding-off section.

Introductory Section

Organizing a favourable mental set.

In a class of thirty pupils each with a different mental set, a variety of different interpretations may be placed upon the same object or word presented to them, and all these interpretations may differ from that of the teacher. Therefore it is desirable to organize a similar mental set in all the pupils.

The organization may be accomplished in several ways:

(*a*) *By 'suggestions.'*

Note the difference in the interpretation of an equivocal drawing, such as *B*, Fig. 2 (p. 138), (i) with no special preparation, (ii) after the suggestion, "Here is a picture by a modern artist," (iii) after the suggestion in the title, "A Week-end out of Doors."

Suggestion (iii) calls up images of holidays, picnics, and the usual arrangements for an open-air meal. Thus a preliminary schema is organized in connexion with the object presented, which determines a given interpretation.

(*b*) *By telling a story or giving a description which calls up and organizes appropriate ideas.*

(*c*) *By recapitulating at the beginning of each lesson the salient points of previous lessons relevant to the new material.*

(*d*) *By stating the aim of the coming lesson.*

[1] See Bibliography at the end of this chapter.

A clear statement of aim serves three purposes. It calls up relevant ideas, it excludes irrelevant ideas, and it specifies a definite objective to aim at which helps to increase the interest. Lessons with no clearly stated or implied aim are most tiresome. Pupils are confused. They wonder what it is all about and try first one alternative and then another, quickly losing any grasp and any interest. The words used by the teacher may all be comprehensible, and the presentation logical, yet if the aim is not clear to the pupils the lesson may be a failure. Westaway records the case of a bright boy who said at the end of a science-lesson, "I am awfully sorry, sir, but although I was easily able to follow Mr X in everything he said, I do not understand at all what he meant to teach us." [1]

The aim can be indicated in several ways. The most direct is a plain statement of the objective of the lesson, *e.g.*, "In our last lesson we studied the position and physical features of Australia. To-day we will find what sort of climate Australia has, and how it compares with our own." By this means the objective is indicated, knowledge of climatic conditions in general recalled, and interfering systems of ideas banished.

In science-teaching the best introduction in many cases is a series of questions which indicate quite clearly a problem to be solved.

Instead of telling junior secondary schoolboys that to-day they will learn about the Principle of Archimedes, it is better to indicate the aim as follows:

"When you are washing your hands with a big cake of soap, does the soap feel heavier or lighter when you hold it under the water, than when you lift it out?

"How many of you swim in the baths? Have you noticed, that after you have been in the water for some time, when you walk up the steps to come out of the baths, your body seems to feel heavier and heavier as you get farther out of the water?

"When you dip a bucket into some water in a river or a tank, what do you notice about the weight of the bucketful of water as you pull it out of the river (or tank)? How does it feel if you lower it back again?

"Does an object really weigh less in water than it does in the air? This is what we want to find out.

"How can we find out?"

In this way the pupils are made explicitly aware of a problem arising out of common experience, and a definite objective is suggested.

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[1] *Science Teaching*, p. 65. The whole of Chapter VI, *A Common Cause of Failure*, in Westaway's book is most instructive.

It is often desirable to indicate the scope and aim of each lesson and of larger sections of the syllabus by means of what some American writers have called "The Orientation Lesson."

Thus, in history, the course of events can be sub-divided into periods which have predominant characteristics. Such are the prehistoric, ancient, medieval, and modern periods. In introducing the modern period a lesson should be given in which the scope and the predominant characteristics of the period are sketched in broad outline, and compared with those of the medieval period just completed. Again, each sub-division (*e.g.*, the Renaissance in Northern Europe, the Tudor period in England, the Industrial Revolution) should have a preliminary orientation treatment.

The Main Body of the Unit of Work

Having made a suitable introduction, we pass to the main body of the unit. In this we present new material and guidance.

The manner of presentation will vary in detail according to the source of the experience. We may have one or more of the following:

Directing observations in field-work or educational visits.
Use of specimens in classroom.
A demonstration by teacher or selected pupils.
Individual study of books by pupils.
Narrative, description, exposition by teacher or selected pupils.
Use of epidiascope, cinema, wireless.
Directing practical work by pupils in laboratory or workshop.

When sufficient content has been supplied and grasped clearly, it must be systematized.

The main body of the unit includes the phases of analysis and synthesis. The purpose and method of these phases has been indicated in Chapter VII.

During the presentation of the main body of the lesson it will be necessary to sub-divide the work into convenient short sections, recapitulating at the end of each section.[1] If the pupils' responses show that the significance of that section has not been thoroughly grasped, it will be necessary to repeat some or all of the section with special emphasis on the weak places revealed in the recapitulation.

[1] Refer to Chapter X for details.

Rounding-off Section

Final Recapitulation

When the end of the presentation has been reached, a final comprehensive recapitulation is indicated.

Its purpose is to weld the various sections of the work into an understandable unity. The pattern of the arrangement, the logical relations involved, and the relative value of individual items can be stressed.

Permanent Record

Some permanent record of the new gains should be made by the pupils as an aid to future revision.

These may take the form of:

Notes, drawings, summaries.

Collections of typical examples of work of literary or pictorial art. These can be gathered by pupils to build up a scrap-book, or anthology.

Collections of specimens mounted and labelled.

Notes and summaries should represent the pupils' own work as far as is possible. Younger pupils will need guidance in making notes and summaries, but the aim of the teacher should be, continually, to train the pupils in making their own notes and summaries.

A decent standard of neatness, accuracy, and order should be demanded, and if necessary, enforced. In the reaction against the copper-plate copybook perfection of drawing and writing which was the ' be-all and end-all ' of some former elementary education, there has been a rather deplorable tendency to allow slap-dash, untidy, written work. This tendency has been strengthened by the overloading of scholarship and secondary-school syllabuses for examination-purposes. In consequence many pupils pass out, from secondary schools particularly, with bad habits and low standards of workmanship.

Occasionally, specialist teachers adopt the attitude that this part of the work does not concern them. Their business is to teach science or geography or literature and not writing or neatness. This attitude is thoroughly unsound. In the first place, standards of neatness, accuracy, clear expression cannot be divorced from subject-matter. Secondly, if the attitude is tolerated it becomes nobody's responsibility to make sure that pupils are effectively trained to adopt and maintain decent standards of work.

Exercises

Exercises fall into two main types:

Exercises for routine practice.

These are essential if the new knowledge or skill is to be retained permanently, and if a high standard of facility is required.

Creative exercises.

In this type the pupil is required to apply his newly acquired knowledge or skill to the solution of problems, or to express his own ideas and feelings in some simple (and, for him, original) example of craftsmanship.

It is now generally agreed by expert teachers of 'appreciation,' that lessons which aim primarily at æsthetic enjoyment should be followed by opportunities for the pupils to compose simple melodies, make pictures, or write stories, poems, plays, or descriptions. Successful teachers of appreciation seem to be unanimously agreed that many pupils, in fact a surprisingly large number, find pleasure in such exercises and show a spontaneous desire to try them.

In the absence of creative exercises of any kind, the educative process degenerates into a dull, purposeless and therefore lifeless routine of memorization and habituation.

Exercises serve two purposes:

(i) For the pupils, they provide:

(*a*) Practice which strengthens the knowledge and skill gained, and enhances the degree of æsthetic enjoyment. It is probable that full appreciation is not attained until pupils gain some insight into the craftsmanship of art, and realize its difficulties.

(*b*) A means of self-examination.

The need for application of knowledge and skill reveals weaknesses which cannot be glossed over. Each pupil then can attack his own special weaknesses. It also reveals strength and with the realization of strength comes enjoyment in the exercise and a desire for further advance.

Thus the exercises are a valuable factor in continuous motivation.

(ii) For the teacher they provide definite responses which indicate the extent and the adequacy of the pupils' learning. This brings us to a very important aspect of teaching, namely, following-up the work done, diagnosing and correcting errors.

NO IMPRESSIONS WITHOUT EXPRESSION

This is a very valuable educational slogan popularized by William James.[1] It means that any impressions presented to the pupil in the course of teaching should be followed up by requiring the pupil to react appropriately with respect to them. This overt response by the pupil is essential because:

It provides a corrective agency for the pupil himself, *enabling him to compare his own performance with some standard or model which is accepted as correct.*

It provides the only possible means by which the teacher can find out how the pupil's internal mental organization is progressing. It is essential, therefore, for the practice of mental hygiene, which is just as much a part of the teacher's work as is instruction.

The first point is important because, with regard to the sufficiency of our own beliefs, we are all such incorrigible optimists. For example, we look at a motor-car or a horse. We note a general vague outline and some (often inconsequential) details. When we see a similar object a second time we recognize it sufficiently well for our everyday needs and fall into the comfortable belief that we know all about it. If, however, we are required to draw a sketch of the object from memory (*i.e.*, to express our impressions) we then realize with a shock how inadequate our grasp of the impressions really is. Similarly, the best way to realize the weak points in our grasp of a logical argument is to work out the argument from memory or attempt to apply it to another problem.

ERROR AND DIAGNOSIS

However clear the presentation may have seemed to the teacher himself, he can never take for granted that either verbal or concrete practical material has been correctly interpreted and assimilated by any one of his pupils. He must therefore take steps to find out what actually has happened. *Every presentation must be followed up systematically to detect and correct possible errors.* Omission of this follow-up procedure is one of the main sources of incompetence in teaching. Good follow-up work is an essential distinction between teaching and preaching or lecturing. It is the more necessary in proportion to the immaturity, paucity of experience, and lack of intelligence of the pupils.

[1] See *Talks to Teachers,* Section V, "The Necessity of Reactions."

As with recapitulation, the follow-up may alternate with sections of the presentation if the topic is extensive. In no case, however, should a follow-up be allowed to spoil the logical or æsthetic continuity of the work. This tends to kill interest and produce a feeling of frustration and irritation in the pupils. A systematic follow-up should *follow the completion* of each section of the work, but not necessarily immediately afterwards. With older and more intelligent pupils a period of reflection may be given. During this period difficulties not at first apparent may become clearer to the learner himself.

The main sources of error are:

1. Lapses of attention. The pupil fails completely to note some significant part of the presentation.

2. Distorted interpretations

(*a*) A pupil may fail to note some part of the presentation, and the gap makes the rest of the work unintelligible. In this case the pupil may try to fill in the gap by imperfect correlate-eduction or reproduction, in such a way as to make the whole sensible to himself. Such additions may, however, have no connexion with the actual facts as presented.

(*b*) Some part of the presentation may be noted, but at the same time be obscure to the pupil. In that case he may interpret the experience in terms of some crude and false analogy. Children make use of the most absurd analogies, *e.g.*, butterflies make butter; butter comes from buttercups; grasshoppers make grass; kittens grow on the pussy-willow.[1]

3. Lapses of memory.

4. Poor methods of working.

The aims of the follow-up process must be to reveal the precise nature of the error; to ascertain the cause of the error; and to correct the error.

It is not sufficient to find out the actual errors, and correct them perfunctorily by repeating the relevant parts of the presentation. The fact that an error has been made may be a symptom that the mental background, which is the medium of interpretation and assimilation, is itself badly organized. Merely to repeat some part of the presentation may appear to effect a superficial correction of a pupil's difficulty, but it is just as likely that *the repetition itself will be wrongly interpreted again.* The ultimate aim of the follow-up

[1] "The Contents of Children's Minds on Entering School," Stanley Hall, *Aspects of Child Life and Education.*

process must be to *reveal defects in the pupils' mental backgrounds and to discover lack, or weakness, of specific aptitudes.*

The absolute importance of good following-up is evident when we consider that the effects of wrong interpretation are cumulative. An error made to-day and allowed to remain unchecked will itself be the cause of further errors to-morrow, and these again on the next day, and so on.

THE PROCESS OF DIAGNOSIS

In this following-up work a teacher is comparable to a physician. The physician is concerned with the physical health and hygiene of his patients, the teacher with the mental health and hygiene of his pupils. Their methods of approach to a problem of disease are also comparable. When a patient with some obscure internal complaint consults his physician, the latter's problem is to discover the nature of the complaint and *locate its cause*. How can this be done ? The physician cannot see inside his patient. He cannot proceed forthwith to cut the patient to pieces to discover the cause of difficulty. Instead of this drastic method of investigation, he applies certain tests, *the purpose of which is to produce a response*. The physician knows what should be the response of a healthy person to each particular test. He applies the tests systematically until he finds an *abnormal* response. From the nature of the abnormal response he must then infer the cause of trouble.

If the physician cannot see directly into the 'innards' of his patients, still more is the teacher unable to see directly into the minds of his pupils. He also must apply tests which *call forth definite responses* from his pupils. The teacher knows (or should know) what constitutes a healthy response to his test. Then, when he finds abnormal responses, or no responses, he must suspect mental difficulty and try to infer the cause.

What kinds of tests will elicit the responses necessary for the teacher's diagnosis ? There are :

Questions about matters of fact to which a verbal or written reply can be made.

Requests to pupils for verbal or written reports on matters of fact, opinions, conclusions, etc.

Exercises and problems which can be solved correctly only if the relevant knowledge has been correctly assimilated (*e.g.*, problem questions in arithmetic, geometry, physics).

Instructions to pupils to make models, sketches, diagrams ; to perform practical experiments (including experiments in art-expression).

It is useful to note that for diagnostic purposes *the wrong responses are more valuable than correct ones.* If the pupil makes a correct response to a test question or exercise, it is highly probable [1] that his impressions have been adequate and his interpretations correct. The teacher can then pass on to further work. If the response is wrong it reveals a difficulty which must be treated.

Now suppose a pupil makes no response or a wrong response to a test. Two alternatives are implied:

(*a*) The impressions presented to the pupil have not been received at all, owing to momentary lapses of attention, or to distracting conditions in the classroom at some instant. Another pupil may have sneezed, or dropped a book with a loud bang, just as an important statement was made by the teacher. If this case is suspected (*e.g.*, by taking into account the usual level of attentiveness and intelligence of the pupil) the relevant information can be repeated, or the pupil's attention re-directed and then the test applied again.

(*b*) The impressions have been received, but misinterpreted. In this case the difficulty is most probably due to a faulty mental background. Mere repetition of the impression will not correct the mistake. Supplementary questions and tests *each demanding specific responses* must then be given until the root of the difficulty is isolated.

In framing diagnostic questions and tests, one must make certain that each test is concerned with *one point of difficulty only.*

Suppose we find that a pupil cannot do correctly a long division sum. It is a futile waste of time to give him more long division sums in the pious hope that after he has worked through many examples, the light will dawn in him spontaneously. It is better to note the specific ways in which it is possible for the pupil to go wrong. Can he add simple numbers correctly? Can he deal with carrying figures? Can he subtract correctly? Can he multiply? Does he know all his multiplication tables correctly? Can he deal with remainders? Etc., etc. For each of these possible difficulties a specific test can be applied which involves that particular difficulty *and no other.* When the actual difficulty has been revealed, it can be treated.[2]

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[1] Note that it is not absolutely certain.

[2] See Green and Jorgensen, *The Use and Interpretation of Educational Tests,* for examples of diagnostic procedures.

This may sound a formidable programme. However, the time spent in diagnosis is more than regained later, since the teacher's knowledge of individual pupils is so much more certain and precise, and the correction of the difficulties more radical and effective. Further, after some experience, it will be found that certain difficulties frequently recur in many pupils. A working-knowledge of these common difficulties makes diagnosis more rapid.

TO WHAT EXTENT SHOULD A TEACHER PERSIST WITH THE FOLLOW-UP TREATMENT?

This depends upon the circumstances of the teaching. If a group of pupils is engaged in individual work, then it is desirable to take each individual and continue the diagnostic treatment until the difficulty has been overcome. Meanwhile the other pupils have their own work to keep them busy and interested. In class-teaching, however, we must not lose sight of the welfare of the class as a whole. In this case, after each subsection of the presentation has been made, one can ask for responses from certain pupils. If distortion has occurred and is not serious, it may be corrected quickly and the presentation resumed. If the distortion appears to be general among the pupils, the presentation can be repeated, possibly *using another method of approach.* If, however, there appears to be some serious difficulty with one or a few pupils only, it is not desirable to persist there and then with the complete correction of these few. The remainder of the class will be bored by the interruption and lose interest. In this case it is more desirable to proceed with the presentation, give the majority of the class some further work, and then, at the first opportunity, treat the few mistaken pupils individually.

SUMMARY

The practical stages in the organization of a typical unit of work may be summarized in the table on p. 330. It must not be supposed that all the details in the second column will be included in every unit. The exact procedure in any given case will depend upon the logical structure of the unit. Thus in some lessons no generalization or definition is arrived at. In such cases that item will not appear in the 'lesson notes.'

The variations in procedure according to the logical form of the subject-matter will be indicated in a later section of this chapter.

TABLE SHOWING IN SUMMARY FORM THE PRACTICAL STEPS IN THE ORGANIZATION OF A UNIT OF WORK AND THE CORRESPONDING PSYCHOLOGICAL RESULTS.

1. Introductory Section	Organization of favourable mental set in relation to new material for study. Statement (or other indication) of the aim to be realized by the unit of work.
2. Main Body of Unit	Presentation Setting forth the new material to be studied. (Or working out a project or assignment.) Guidance Analysis—leading to clearness of apprehension. Abstraction. Synthesis—leading to system and culminating, in cases of inductive development, in formulation of general principle, or definition.
3. Rounding-off Section	Final recapitulation. Permanent record. Follow-up process—Diagnosis of error. Remedial measures. Application (*a*) Exercises for practice—Consolidation of results. (*b*) Exercises for creation.

This plan for the organization of a unit of work will apply to schools or classes working on the Dalton Plan, or the Project Plan. Under whatever plan the pupils work, the psychological phases through which their knowledge develops remain the same. Thus, in drawing up assignments for individual work according to the Dalton Plan an introductory section is necessary to organize the pupils' mental set and indicate the aim. The presentation will consist of (*a*) written references to sources of information, and (*b*) instructions or suggestions, the purpose of which is to guide the pupil through the processes of analysis, abstraction, synthesis, and generalization. When working under the Dalton Plan, the follow-up process is even more important than in the case of orthodox oral teaching, since the pupil is working silently during the 'body of the lesson' and is therefore more liable to accumulate distortions in interpretation. Also it must be remembered that although individual work may be more efficient than *mechanized* class-teaching, at the same time there is no magic in the process. Immature pupils still require sufficient practice exercises to promote speed, accuracy, and skill in application.

The grave weakness of the Dalton Plan, in schools where each teacher must deal with thirty or more pupils, lies in the fact that the

essential work of guidance and follow-up cannot be carried on so thoroughly as in good class-teaching. It is very largely a problem of time. If thirty pupils are to get the guidance and diagnosis they need, as individuals, it is obvious that each one can have only a small fraction of the time which would be available if groups of pupils are dealt with simultaneously. In practice, one usually finds that no matter with what uncritical enthusiasm the pure Dalton Plan is adopted in an ordinary elementary or secondary school, before long, modifications have to be introduced in order to economize time and increase the guidance and follow-up work by teaching groups simultaneously.

Similarly, in organizing projects, the project or problem must be clearly indicated, and its bearing on other work discussed. During the development of the project guidance is necessary if the results of the work are to be educationally valuable. Finally, practice and follow-up work must be undertaken.

Like the Dalton Plan, the Project Plan has its own characteristic difficulties, the chief of which is a tendency to superficiality and lack of system and intellectual discipline. The project does not allow of sufficient time for the practice of fundamental skills, and the subject-matter may remain in the minds of the pupils as a collection of topics rather than a system of knowledge.

Actually, no kind of plan of school-organization, whether Montessori, Dalton, Project, Heuristic, and so forth, will make it unnecessary for the teacher to understand the essential psychological principles according to which the normal pupil develops. Usually, the more one departs from class-teaching the more thorough and scientific must one's psychological knowledge be.

ARTICULATING A SYLLABUS

Beginners in teaching frequently find difficulty in *articulating* a syllabus, *i.e.*, arranging beforehand how the work to be done shall be allocated in the time available.

For this purpose we need to take note of:

The number of periods per week allowed for the subject in question.

The length of the time-table periods.

The intellectual capacity of the pupils which determines the pace at which they can assimilate the work.

Having ascertained these facts the syllabus can be sub-divided into units of convenient length according to the logical form of the subject-matter. But, in estimating how much work is likely to be covered in a term or a year it is necessary to allow adequate time for recapitulation, for exercises, permanent records, revision,

and diagnosis. Most beginners *overcrowd their work-periods with subject-matter* because they forget to take account of these other essential factors.

B. Modifications of Procedure required by Different Types of Subject-matter

We must teach something to somebody. Hence we must take account, not only of the psychological processes in the learners, but also of certain differences in the formal structure and value of the subject-matter itself. We can distinguish six main types of subject-matter, each of which will require its own special treatment. They are:

(i) Subject-matter mainly descriptive and informational, leading to increase in the learner's knowledge of his environment, and enrichment of his imagination. Examples are: literature; descriptive geography and history (including biography and travel reports or stories); nature-study; elementary mathematics, physics, chemistry.

(ii) Subject-matter mainly concerned with the inductive development of generalizations, leading to the systematization of knowledge. Examples are: grammar; physical geography; certain aspects of mathematics; certain aspects of experimental science.

(iii) Subject-matter mainly concerned with deductive application of facts and principles already established. Examples are: formal geometry, advanced grammar, theoretical (particularly applied) science and mathematics; critical studies in more advanced geography, history, economics, literature, and the fine arts.

(iv) Subject-matter mainly concerned with experimental investigation and scientific research.

(v) Subject-matter mainly concerned with the development of skill. For the sake of clearness and convenience we can take account of two types of skills:

(*a*) Practical skills, *e.g.*, shorthand, typing, handling craft-tools and scientific instruments.

(*b*) Mental skills, *e.g.*, observing, defining, generalizing, reasoning.

(vi) Subject-matter mainly concerned with the appreciation or enjoyment of literature, music, and pictorial art.

Limits of space prevent detailed illustration of the procedures necessary for each type of subject-matter. A general indication will be given and readers can work out specific topics in detail as exercises.

SUBJECT-MATTER WHICH IS MAINLY OBSERVATIONAL AND DESCRIPTIVE

With this type, the aim must be to present new experiences, directly or indirectly, in such a way that the pupil's knowledge of the environment is clarified and extended. The teaching should secure that objects and situations in the environment are analysed into basic characters and relations, which can then be abstracted and described accurately in words.

In lessons of this kind we are concerned mainly with the order in which the subject-matter is introduced, and it is in this respect that the student-in-training seems to find most difficulty. He will have studied his subject-matter at college in an abstract systematic way, usually by the aid of standard text-books. If he wishes to read more information about an unfamiliar topic he will go first to a text-book or encyclopædia and read through an abstract formal introduction which is then presented without modification to the pupils, often with the 'aid' of abstract diagrams—plans, elevations, sections, etc. This is precisely the wrong order for teaching-purposes.

Information lessons should have the following general form:

An introduction to arouse anticipatory interest and indicate the scope and aim of the lesson to follow.

Presentation of the new material:

(*a*) If the pupils have not yet had adequate first-hand experience of the objects and situations to be discussed, this should be provided if possible.

If first-hand experience is not possible then the children's local experience must be supplemented by substitute-experience in the form of pictures, cinema-films, or models.

(*b*) In deciding upon the order in which to present the items of information we should ask ourselves in each case—*have the children already acquired a sufficient apperceptive system to interpret this particular item adequately and clearly?* If the necessary interpretative system is not there it must first be organized. In a well-presented lesson, each new item finds an appropriate interpretative system already organized for it into which it fits intelligibly. If this rule is applied with a sympathetic insight into the pupils' available mental resources, the lesson-material cannot fail to be clear.

Much good use can be made of analogies, both verbal and material, drawn from the local environment. Thus in a lesson on the human eye we can utilize the fact that the formal structure of the eye resembles that of a box-camera—lens, diaphragm, sensitive film, and strong walls to hold these parts together. Even if bulls' or sheeps' eyes are dissected (as they should be in any case) the camera analogy is still useful as it represents a less complicated arrangement containing only the most essential features.

The teacher's aim in these lessons should be to bring out explicitly the significant characters and relations in the material presented. This can be done by directing attention specifically to these items. New names must be supplied as the characters and relations are explicitly realized and abstracted.

In these lessons there is no logical generalization, and strictly speaking no application. The aim is to increase clear experience of the environment. The presentation will be rounded off by recapitulation, permanent record, and follow-up for correction of errors.

SUBJECT-MATTER INVOLVING MAINLY INDUCTIVE DEVELOPMENT

This type occurs frequently in grammar, geography, nature-study, geology, elementary physics, and chemistry. The aim of the lesson is to establish clearly a classification, or general principle.

The method of presentation will consist in setting forth a number of cases each possessing the significant character or relation in question, but differing in all other respects. In each case attention must be directed specifically to the significant common characteristic. This can often be made still more definite by presenting cases not possessing it. Thus in an elementary demonstration of capillarity it is customary to dip substances like sponge, blotting-paper, lamp-wick, unglazed earthenware into coloured water and show that in each case the liquid rises up within the substance. On comparing the substances it is made clear that all have a common character—porosity.

This character and its relation to the rise of the liquid can then be made more striking by dipping non-porous substances like a wax candle, solid glass rod, glazed paper, glazed porcelain into the same liquid. Now the water does not rise.

Another instance was shown on p. 215, where the function of the preposition was indicated by induction.

When sufficient cases have been presented, and the comparison and contrast made, the generalization can be stated in words.

After recapitulation, permanent record, and follow-up, it is desirable to apply the generalization to the elucidation of new cases.

At the post-primary stage the pupils should be introduced specifically to the commoner fallacies of induction, *e.g.*,

Have the facts been correctly observed and stated ?

Have sufficient clear *representative* cases been noted to warrant a generalization ?

Have the cases noted been specially selected in any way in order to 'prove' an already favoured hypothesis ? (Selection of cases to 'prove' a prejudice is very common in history, economics, and political science.)

Can any negative cases be found ? The possibility of negative evidence must always be kept in mind in making inductive generalizations. One negative case has more value as evidence than several hundred positive cases.

Properly conducted, these inductive-development lessons can be made into a powerful medium for cultivating a cautious, critical scientific attitude.

SUBJECT-MATTER INVOLVING MAINLY DEDUCTIVE DEVELOPMENT

This will occur in the lower forms mainly in geometry. At the post-matriculation stage it is increasingly common in physics, chemistry, and the mathematical aspects of geography, geology, and biology.

Usually it takes two forms :

Demonstrating the proof of a theorem.

Solving a problem and then demonstrating the formal correctness of the proof:

The steps in the deductive development are as follows :

Demonstrating a Proof :

Enunciating a theorem.

Following up the enunciation to ascertain that all the key-terms are clearly understood.

Setting out the data.

The pupils should be required to state *exactly what has been given* in the theorem. This step is most important since beginners are very prone to take for granted just what they are required to prove.

Stating exactly what is to be proved.

Formulating the proof.

This should be done as a co-operative effort by pupils and teacher, the teacher guiding the pupils when they are in difficulties.

Recapitulation, permanent record if necessary, follow-up to check errors in apprehension.

Application of the theorem proved to the solution of further theoretical or practical problems.

Solving a Problem:

Enunciating the problem.

Follow-up to ascertain that the terms are clearly understood.

Setting out the data given, and the *exact conditions to which the solution must conform.*

Evolving the solution.

Here it is often useful to imagine the problem solved, analyse the conditions necessary for a solution, then reconstruct the solution formally. This is the well-known method of working backward.

Proving the solution.

Recapitulation, permanent record, follow-up.

As in inductive development, so here it is essential to bring the nature of the reasoning process itself, and the common fallacies likely to be met with, explicitly to the notice of the pupils. Deductive reasoning is a powerful *general* method which can be applied to many different kinds of material conditions if the process is explicitly realized.

SUBJECT-MATTER INVOLVING EXPERIMENTAL INVESTIGATION

The essential formal steps in this type of development have been indicated in the report of Lavoisier's work on combustion (p. 217). They are:

Ascertaining the exact nature of the difficulty. This includes a preliminary test in some cases to make sure that the problem has been correctly stated. It may be found that

the supposed problem has arisen from an error of observation or interpretation, *e.g.*, before investigating the appearance of a ghost, it is desirable to establish first that a ghost has actually appeared! It may turn out that some frightened person has seen a scarecrow or a signpost in the moonlight. Such a fact disposes of the original problem.

Working out imaginatively possible solutions of the problem or explanations of the difficulty—this amounts to formulating a number of alternative hypotheses.

Stating the implications of each hypothesis in such a way as can be tested by quantitative experiment.

Making the experiments.

Considering the bearing of the results on the original problem.

These steps can be worked out quite easily even in lower form chemistry and physics. Consider, for example, the case of the Principle of Archimedes.

It would appear from casual observation that objects weigh less in water than in air. The problem is: Do they really weigh less in water than in air? How can this be tested?

This introduces a subsidiary problem, namely, how can an object be weighed while it is under water. There is scope for ingenuity in arranging some apparatus for this purpose.

When weighed in water, an object will be found to have lost weight. Therefore there is a problem to explain. What is the cause of the loss of weight?

Now hypotheses can be stated, *e.g.*,

(i) The substance of the object itself has changed its nature on being submerged, and has not now the same *mass*.

(ii) The water displaced by the object when submerged is pushing it upward. (Incidentally this seems to have been the hypothesis which so excited Archimedes that he rushed into the streets without his shirt shouting 'Eureka.') [1]

Next the implications of each hypothesis must be stated in such a way that they can be experimentally verified. (Readers can work these out, in the present case, for themselves.)

At the completion of the tests, the whole topic can be recapitulated, a permanent record made, and details followed up.

Presented in this way to intelligent pupils science becomes an adventure, often quite exciting. Moreover, the pupils are

[1] Eureka, *i.e.*, I have found it.

familiarized with a most powerful general method of procedure. Again, the formal nature of the procedure, and the checks necessary to control it, should be made explicitly clear to the pupils.

It is not necessary that the pupils should do all the experimental work. At the junior secondary-school stage, practical laboratory manipulation can be overdone. Much exciting and intellectually valuable scientific work can be accomplished by a lecture-demonstration method. In fact for teaching scientific method as against training in routine laboratory manipulation, the lecture-demonstration method is quite valuable.

It should be noted in passing that many of the simpler scientific laws can be introduced to intelligent boys and girls in such a way that they actually rediscover the laws in question. The topics must be introduced *from the standpoint of the original investigator* and by following out his train of thought the *process* of scientific investigation is brought clearly to the notice of pupils as well as the results achieved. The results themselves often come as a surprise to the pupils and the whole becomes extremely interesting. This is what Sir T. P. Nunn has called, "putting the pupil into the skin of the scientific discoverer."

Too frequently, scientific principles are taught in quite the wrong way, simply as pieces of bookwork. In this case, the laws are merely stated by the teacher or set out in a text-book, and the experiments then become dictated devices for verifying the laws in question. Since the law is known already before any experiments are made, the element of rediscovery which is the essential intellectual factor in good science-teaching is completely missing.

Science taught in this way can be abominably dull and intellectually deadening. It is on a par with memorizing moral aphorisms out of the scriptures, or technical grammar rules in Latin. Good Latin, intelligently taught, will reveal to an able pupil far more about the reality of scientific thinking than any amount of stereotyped dictated experiments undertaken to verify already stated laws.

The procedure indicated above is very useful in organizing lessons in what might be called 'science-handwork,' *i.e.*, the design and production of simple machines and apparatus. In this case the problem becomes the production of a piece of apparatus to serve a specified purpose. Suggested designs are drawn out as rough sketches by the pupils. The designs are then criticized, and obvious faults in them discussed. When the design is suitably modified and seems likely to be successful, the pupil draws it accurately in detail. The constructional work is then carried out. Finally, the apparatus is assembled and tried.

Handwork organized according to this procedure, when pupils have some facility in the use of tools, affords much scope for ingenuity and inventiveness, and is highly interesting to 'mechanically minded' boys. The same treatment is possible in domestic science and needlework for girls.

In connexion with the discussion on transfer of training, this investigatory method is capable of transfer to many other types of subject-matter. As an illustration let us consider its application to history. Suppose we were dealing with some specific topic with a good set of post-matriculation pupils, who had access to some historical sources. Let the topic be the Peasants' Revolt.

The scientific person would begin by asking a question. Was there *in fact* a Peasants' Revolt, or is the text-book account (*a*) an interpolation by some ingenious and romantic chronicler, or (*b*) a report of a widespread rumour? Such a rumour is by no means an impossibility.[1]

Here then is a first-class problem. How can it be settled? Where can we turn for evidence, and *what sort of evidence will be accepted as satisfactory*.

Thus the problem leads to an investigation of sources and a critical attitude to methods and results.

Having settled that there was a Peasants' Revolt, the next problem is to ascertain exactly *how* it happened. What were the facts of the case?

Having the facts, it is then necessary to discuss causes. *Why* did it happen? Here it might be a very educative procedure for the pupils if the asserted causes given in the text-book were treated as so many possible hypotheses and used as starting points for investigations.

It is agreed, of course, that such a method of treating history would not cover much ground in a short time, and it might not, therefore, be a good preparation for an examination. Also, it would require a class of intelligent pupils and an intelligent scholarly teacher. However, if only a few representative problems were thus treated it would provide a valuable element in a good general education, not only in history itself, but also in the scientific attitude and scientific method. Moreover, the training might spread to, say, newspaper-reports, advertisements, and other common

[1] Consider some of the fantastic notions that found their way into print during the Great War of 1914–1918. Medieval people seem to have been, if possible, even more credulous than the modern newspaper-reading public. Or it may be that their credulity expressed itself in rather different directions.

forms of propaganda. And it might make history an interesting subject.

LESSONS AIMING AT DEVELOPMENT OF SKILL

We can include here two types of skill:

(*a*) Mainly depending on muscular co-ordination, *e.g.*, physical exercises, games, athletics, practical handicraft, writing script, reading aloud, etc.

(*b*) Mainly depending upon the use of some logical, grammatical, or artistic method of operation, *e.g.*, use of the accusative-infinitive construction in Latin; solving a problem in experimental science; solving a problem in geometry by assuming it to be completed and working backward; solving a quadratic equation; writing an essay, or sonnet.

For this purpose we can proceed as follows:

Introduction

Encourage motivation by inducing a favourable attitude to the learning. This is best accomplished by showing clearly what purposes can be served by mastering the skill. If a child can see some use in learning a skill he is usually much more ready to learn, than if the learning has no apparent purpose.

Presentation

Demonstrate clearly by means of a good model exactly what is to be done.

Guide pupils' attention to the various phases of the demonstration and to points of special importance or difficulty. (*Cf.* Cox's experiments in manual training, pp. 243–244).

Follow up by questioning pupils about the end to be achieved, and the special features of the demonstration. In all learning of skills it is essential that each pupil shall have as clear a notion as possible about what is to be accomplished by the practice, and how the practice must be carried out *before it is actually commenced.* Confusion about these points leads to bad-habit formation together with loss of confidence and interest.

Practice

Allow pupils to attempt to perform the process themselves.

Correct bad practice both by further demonstration to the whole class, and by individual treatment.

When the correct procedure has been grasped in outline, give exercises for repetition, making use of the rules for motivation and efficient learning already given (p. 126).

Application

Let pupils use the developing skill in order to accomplish some constructive work. In connexion with this application an interesting problem arises. Is it better to maintain the artificial routine-exercises in a particular form of skill until proficiency is established, or should pupils be allowed to undertake some constructive work as soon as they reach partial proficiency?

The objection to routine-practice alone is that it soon becomes tiresome and induces resistance to further practice, whereas the constructive work provides a change of occupation and a new purpose. In teaching pupils how to make a dove-tail joint in wood-work some practice in making dove-tail joints merely, is necessary as a preliminary. As soon as a fair proficiency has been attained, however, further practice is best induced by requiring the pupil to make a model incorporating dove-tail joints. If any special difficulty occurs, a further period of routine-practice dealing with that particular difficulty may be given. The pupil will do this more readily when he realizes that he cannot do the more interesting constructive work without it.

ÆSTHETIC APPRECIATION LESSONS

This topic raises fundamental psychological problems which must be decided, to some degree at least, before it is possible to discuss the organization of lessons in æsthetic appreciation.

In the first place, can æsthetic appreciation be taught, or is it something which depends entirely upon the person who is appreciating? This will depend upon the nature of æsthetic enjoyment.

Here we can give only a brief and possibly dogmatic treatment. Readers specially interested in the topic can follow up this introduction in books devoted specially to the problem.[1]

Appreciation, or, to be more exact, æsthetic enjoyment, *is a way of experiencing and knowing* different in some respects from what may be called intellectual and practical cognition, with

[1] *E.g., The Lesson in Appreciation* (An Essay on the Pedagogics of Beauty), F. H. Hayward. Contains a bibliography. *Training in Appreciation*, Edited by N. Catty.

which we have been mainly concerned hitherto. The significant difference seems to be in the attitude in which the experiencing person approaches the object or situation to be known or appreciated.

A simple example will show the difference implied.

Let the object be a hammer. In *intellectual knowing* we approach the tool in a detached critical attitude. To what class of tools does it belong? What are its significant characters? How are the parts mechanically related? How is its function performed? What mechanical principles are involved? These are the types of questions we should have in mind. We approach the object as a thing in itself apart altogether from any relation it may have to ourselves (except, of course, the relation of knowing it). Our attitude is 'objective,' detached, impersonal. We have no interest in this particular hammer itself, but regard it merely as a concrete example of certain general mechanical principles. Nor have we any interest in any particular practical use to which we could put the tool.

In *practical knowing* we approach the hammer as an object which will serve a useful purpose. Our interest is in the purpose primarily, and in the hammer only in so far as it enables us realize the purpose. Usually we pay only perfunctory attention to the tool itself.

There is, however, a third attitude. A keen craftsman may inspect a number of hammers, and he notes one particular tool. He regards it with pleasure, takes it up, and balances it in his hand. The perfect balance of the instrument and the feeling of personal fitness which comes with handling it gives the craftsman a thrill of enjoyment. The satisfaction comes from contemplating and using the object itself. There is no specific consideration of its mechanical principles, nor interest in its immediate utility for any particular task. This is shown by the fact that the craftsman who finds a superlative tool will exclaim, "What a beauty!" and use it on anything which happens to be at hand, not because any hammering is necessary but just for the joy of using it. Usually in such a case the proud possessor will call other people's attention to it saying, "Look at this! Try it. What do you think of it?" expecting admiration equal to his own.

In æsthetic enjoyment we experience pleasure in the contemplation (or use) of an object or situation for its own sake. Its beauty appeals to us. We feel thrilled and uplifted. The interest does not go beyond the object either to its utility, or its objective characteristics as such.

Æsthetic enjoyment is not identical with sensuous pleasure although the latter is usually an element in the enjoyment. We can experience sensuous pleasure without æsthetic enjoyment, as in experiences of savoury smells, sweet scents of flowers, bright

saturated colours, and the massive feeling given by a warm bath when one is cold and tired.

For æsthetic enjoyment the sensuous pleasure must be accompanied by certain intellectual elements—apprehension of order, symmetry of arrangement, proportion, balance, harmony. This is shown by the fact that the same objects can produce both enjoyment and repugnance, according to their arrangement. A familiar example is a vase, with flowers either tastefully arranged or just pushed in roughly in a bunch. The intellectual elements just mentioned provide a major part of the enjoyment of certain mathematical patterns—including mathematical calculations and proofs. To a mathematician an exercise in the calculus is an object of enjoyment compared with an exercise in ordinary arithmetic which may arrive at the same result but in a roundabout, clumsy, *ugly* way. Here the sensuous elements are reduced to a minimum—a series of black marks on white paper. They have no particular beauty in themselves. The object contemplated and enjoyed is an arrangement of ideal order. Moreover, a mathematical proof may have no practical utility whatever. Yet it can produce in the mathematician a thrill of enjoyment comparable to the musician's delight in a concord of sweet sounds, and the artist's delight in a harmony of colours.

The intellectual elements, however, remain as a background in æsthetic enjoyment. They are apprehended in a synthetic way as part and parcel of the object contemplated. So soon as we pass from a contemplation of the beautiful object to an analysis of its specific characteristics, the æsthetic enjoyment ceases and we pass into the critical detached intellectual way of knowing.

This point is shown clearly in the case of literary passages :

> But now farewell. I am going a long way
> With these thou seëst—if indeed I go
> (For all my mind is clouded with a doubt)—
> To the island valley of Avilion;
> Where falls not hail, or rain, or any snow,
> Nor ever wind blows loudly; but it lies
> Deep meadow'd, happy, fair with orchard lawns
> And bowery hollows crown'd with summer sea
> Where I will heal me of my grievous wound [1]

This passage might be used as a grammatical exercise for practising analysis and parsing. (It was thus that I first became acquainted

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[1] Tennyson, *Morte d'Arthur*.

with the passage in school.) It might be used as an example of literary style, and the passage analysed for the purpose of discussing its poetic structure and characteristics, and the reasons why it may be called good poetry (or bad, as the case may be). These are instances of the intellectual attitude in knowing the passage.

It might also be part of the three hundred lines of poetry which together with knowledge of meaning and allusions were required by the 1875 code for the last year in the elementary school course. As lines to be memorized by heart for inspection purposes the passage above would be as good as any other equal number of lines. Here it fulfils a practical purpose, and would be approached primarily with a practical attitude.

In neither of these ways would æsthetic enjoyment be obtained fully. The intellectual or practical attitude interferes with the æsthetic attitude which seeks to know the passage for its own sake on account of the enjoyment produced in reading and contemplating it.

It is clear that in æsthetic enjoyment we are dealing with sentiments. Æsthetic sentiments are acquired associations between cognitive and feeling- plus-conative elements, in which the feeling-elements strongly predominate and the object of the sentiment is some form of beauty.[1] Thus æsthetic enjoyment can develop from crude experiences of sensuous pleasure in childhood to a refined and strengthened love of beautiful things and an ideal of beauty in later life. As the sentiment develops on its positive side as a love of beautiful things, it will develop on its negative side as a hatred [2] of ugly things.

Attunement and Absorption

The distinguishing character of æsthetic enjoyment as a way of knowing seems to be the more or less complete *absorption of the observer into a unity of being with the object or situation observed.* The more complete the absorption, the greater the enjoyment. The observer becomes one with the object and, for the time being, shares its nature. The beauty of mountains is in their grandeur and massive strength, and when the mountain-lover contemplates this beauty in a mood of æsthetic enjoyment he is absorbed within the scene and for the time being shares the grandeur and power.

Many mechanically minded people can be absorbed in the contemplation of a machine and experience a feeling of identity with the

[1] Compare with moral sentiments where the object is some form of moral conduct.

[2] *I.e.*, dislike reinforced by feelings of disgust and repulsion plus a desire to destroy the offensive ugliness.

machine and its power. Guns, aeroplanes, and other engines of destruction can inspire this feeling, and it is possible to feel a thrill and glory in their use and forget for the time being the dreadful consequences. This is a factor which many people who are trying to stop war fail to recognize sufficiently in assessing the causes of war.[1]

Teaching Æsthetic Enjoyment

If this analysis of the factors in æsthetic enjoyment is correct, we can answer the question, " Can appreciation be taught ? "

In so far as appreciation depends upon sensuous pleasures and certain forms of intellectual apprehension, a person cannot, by the nature of things, appreciate if he does not possess the specific or general aptitudes which make the pleasures and the apprehension possible. To the extent that the person's native endowment does not include these aptitudes, he cannot be taught to appreciate.

Hence the problem of teaching appreciation amounts to this. Assuming that the capacity for enjoyment is there, how can the teacher secure that the fullest possible degree of enjoyment will be realized ?

First we must note that since the enjoyment depends upon feelings which are peculiar to each person there will be very wide differences between individuals with respect to the enjoyment of any given object or situation. One man's meat may be another man's poison here as elsewhere. Therefore we cannot present objects of artistic merit to a class of pupils and demand that all shall admire and enjoy at the same time and in the same way.

However, a teacher can assist the process of appreciation in several ways :

1. Select objects worthy of appreciation and likely to be appreciated by pupils of a given age and condition. The teacher's wider range of experience enables him to bring to the pupils' notice many worthy objects which would not be available otherwise. Thus the teacher can arrange opportunities for appreciation and determine a worthy standard of taste.

2. Arrange quiet conditions free from material distraction during which objects and situations worthy of appreciation can be presented with some chance of their being appreciated.

3. Assist in the essential process of attunement or adjustment of the pupil, mentally, before the complete absorption required for full enjoyment is possible.

[1] This is a case where some effective substitute-satisfaction is needed.

4. Present the work to be appreciated in a way calculated to bring out its essential beauty in the clearest possible way.

5. Guide æsthetic discussion by the pupils after the presentation.

6. Provide opportunities for practice and training in æsthetic expression by pupils who show a desire for it.

A Procedure for the Appreciation Lesson

Enumerating what things the teacher can do to assist the pupils' appreciation indicates an outline of a lesson-formula. We have the following 'steps' or phases:

I. Preparation of Pupils.
II. Presentation.
III. Guidance.
IV. Practice (or Creation).

I. *Preparation of Pupils*

This is probably the most important step of all in the practical teaching of appreciation, more important even than the introduction step in the intellectual or practical way of approach. It requires therefore a longer period and a greater measure of consideration and practical skill.

Its importance arises from the necessity that the pupils shall be *attuned to the object or situation presented*—poem, melody, picture—before they can become absorbed within it and apprehend its nature in the *direct immediate* way characteristic of æsthetic enjoyment.

The preparation of the pupils seems to include three aspects, all of which are necessary for full appreciation.

1. *Organization of anticipatory interest*

This has two subordinate phases:

(*a*) Removal of outside interests which may conflict with the appreciation—interests arousing out of worry or excitement about events not connected with the coming appreciation lesson.

(*b*) Building up a positive anticipatory attitude, a readiness to pay attention to the object to be appreciated in the coming lesson.

Such an attitude may be encouraged by suggestions about the lesson in question, allusions to it, associations between items of interest in other lessons (*e.g.*, history, literature, grammar, nature-study) and the subject of the coming lesson in appreciation.

2. *Organization of an intellectual background*

Full enjoyment needs sufficient intellectual background to allow adequate interpretation of the medium in which the work to be presented is expressed. Without this background full apprehension of the significance of the work and therefore complete absorption in it is impossible. In this part of the preparation the aim is to remove any conditions which may cause frustration of full enjoyment. In appreciating a literary work, clear vivid imagery which conveys the exact significance of key words or phrases is essential for full enjoyment.

A quotation from Trench's *On the Study of Words* will illustrate this point. The author remarks that Coleridge said, "In order to get the full sense of a word, we should first present to our minds the image that forms its primary meaning." He then goes on as follows:

"What admirable counsel is here! If we would but accustom ourselves to the doing of this, what a vast increase in precision and force would all the language which we speak, and which others speak to us, obtain; how often would that which is now obscure at once become clear; how distinct the limits and boundaries of that which is often now confused and confounded. It is difficult to measure the amount of food for the imagination as well as gains for the intellect which the observing of this single rule would afford us.

"Let me illustrate this by one or two examples. We say of such a man that he is 'desultory.' Do we attach any very distinct meaning to the word? Perhaps not. But get at the image on which 'desultory' rests; take the word to pieces; learn that it is from 'desultor,' one who rides two or three horses at once, leaps from one to the other, being never on the back of any one of them long . . . what a firm and vigorous grasp will you now have of its meaning! A 'desultory' man is one who jumps from one study to another and never continues for any length of time in one.

"Again, you speak of a person as 'capricious,' or as full of 'caprices.' But what exactly are caprices? 'Caprice' is from *capra*, a goat. If ever you have watched a goat you will have observed how sudden, how unexpected, how unaccountable, are the leaps and springs, now forward, now sideward, now upward, in which it indulges. A 'caprice' then is a movement of the mind as unaccountable, as little to be calculated on beforehand as the springs and bounds of a goat. Is not the word so understood a far more picturesque one than it was before, and is there not some real gain in the vigour and vividness of impression which is in this way obtained?"

Much of the enjoyment of literature consists in just the picturesque, vigorous, vivid impressions conveyed to the listener

or reader by the words. If the words signify vivid accurate imagery one is able to enter into the situation portrayed directly and not "as through a glass, darkly," as is the case when the words convey nothing but confused impressions.

Note that what is desired is not the formal dictionary meaning of the word, but the *concrete imagery* of which the dictionary meaning is a second-hand description. If the pupils know the dictionary meanings of all the words in a poem by heart it will not guarantee that they will appreciate the poem. The very mass of their erudition may indeed prevent the appreciation. Given the vivid concrete imagery, however, they can get as it were through the words to their primary significance.

Hence, for this aspect of preparation, the teacher must familiarize himself with the work to be presented and understand it thoroughly. Each item likely to be difficult should be noted and these items rehearsed with the pupils in periods *previous to the appreciation lesson itself.* To interrupt the presentation in order to inquire into significance of words and allusions is to break asunder the artistic unity of expression and at the same time to translate the mood of æsthetic enjoyment into one of intellectual detachment and analysis, thus effectively preventing full appreciation.

3. *Inducing a suitable mood*

Immediately before the actual presentation it is desirable to induce in the pupils a receptive mood, 'coloured' by the predominant feeling-tone expressed in the work to be appreciated—poem, melody, a picture—which may be sad, solemn, contemplative, or angry, excited, gay, etc.

This can be done to some extent by tone of voice and teacher's manner, by verbal suggestion or description. This process is sometimes called creating an appropriate atmosphere.

In this connexion it is not fantastic to suggest that some consideration be given to the relation between the 'atmosphere' of the work presented and the actual conditions within and without the classroom at the time of presentation. A dark, howling, rain-soaked afternoon in late November is not quite the best setting for the successful appreciation of a poem on gay young lambs in a sun-drenched field in May!

It follows that preparation for the lesson in appreciation may occupy a fairly long period. For fullest success these lessons cannot

be organized according to a rigid schedule—one lesson per week at the same specified time. Rather than risk taking many lessons for which adequate preparation cannot be made, it is better to take fewer but well done.

II. *Presentation*

It is essential that the presentation shall be continuous, in such a way as to enhance the unity of the work to be contemplated. All but the induction of an appropriate atmosphere and mood should have been completed in previous lessons, leaving the present clear for effective presentation.

III. *Guidance*

If the presentation has produced any vivid impressions, the pupils in a free and happy classroom atmosphere will usually comment spontaneously on their feelings, express likes and dislikes, ask questions, etc. Such expressions provide a basis for discussion.

Such discussion falls into two modes with different aims and prevailing attitudes—æsthetic and intellectual.

The æsthetic discussion will be occupied principally with the æsthetic feelings and values, comparing notes about individual responses to the presented work; indicating items which have produced greatest enjoyment; repetition of outstanding portions of the work, etc.

The æsthetic discussion is best taken soon after the presentation while the impressions are still vivid.

After the discussion the whole work or selected parts of it can be re-presented in the light of the discussion.

Note that this æsthetic discussion cannot be forced. Enjoyment is subjective and will not occur in obedience to a command from the teacher. It is necessary to 'feel' the mood of the pupils and refrain from attempting by artificial teaching-devices to elicit expressions of opinion about non-existent enjoyment. Forced protraction of the æsthetic discussion soon becomes tiresome and defeats the purpose of the appreciation lesson. Moreover, some pupils are shy of expressing their feelings in public. Because a given pupil does not give vent to opinions it does not follow that there has been no appreciation. Appreciation is like a tender plant. It needs careful sympathetic cultivation rather than forcing.

Intellectual discussion can be left till a later period. It is more appropriate for senior pupils engaged in the study of music, literature, pictorial art, etc.

The object of the discussion will be :

To clarify still further meanings and allusions.

To discover how the artist has obtained his effects, leading to analysis of art forms, and formulation of principles of style and canons of taste.

The extent to which the intellectual analysis is carried must depend upon the interests, abilities, and needs of the pupils. For younger pupils, and for a general education, only such points as will serve to introduce the pupils to the elements of craftsmanship in artistic expression, and thereby enhance future enjoyment are needed. In literature, for example, such items as choice of words, poetic value of words, alliteration, repetition, contrast, metaphor, simile, rhythm, are interesting and helpful.

In so far as intellectual discussion deals with analysis, abstraction, and generalization, the rules for inductive development already given will apply.

IV. *Practice and Creation*

The abler pupils with some aptitude for artistic expression will desire to carry their studies to the stage of acquiring skill and trying to produce artistic work of their own. When skilfully taught it is rather surprising to find that the majority of the pupils desire to proceed to this stage and produce worthwhile results.

This phase of the process of training deals with the acquisition of skill and can be organized according to the rules for skill lessons.

Exercises

1. From the points raised in the discussion in this chapter, draw up a schedule for use in observing and criticizing a lesson.

The schedule should include suitability of the material selected for a given class of pupils ; amount of material ; effectiveness of the introduction, presentation, follow-up ; teacher's manner ; estimation of the degree to which the aim has been realized, etc.

2. Prepare a syllabus for a month, a term, or a year, in your special subject for typical classes (boys, girls, mixed) of a given age and ability, in a specified local environment.

Arrange the material in a suitable order, having regard to the attainments and ability of the pupils.

Consider the most effective places for recapitulation, summary, revision, and practice.

3. Repeat Exercise 2 but for use on the Dalton Plan.
4. Repeat Exercise 2 for a Project Curriculum.
5. Write out lesson-notes for a specified class of pupils (stating sex, age, and previous knowledge assumed) in the following topics :

A medieval monastery.
Contours.
Measuring the height of a tree or church steeple by methods involving angles.
Proof that three angles of a plane triangle are together equal to two right angles.
Construction of a tangent to a circle from a given point outside it.
Introduction to quadratic equations.
Acids and alkalies.
The Preposition.
Analysis of complex sentences.
Milton's Sonnet on his Blindness.
The Parable of the Sower.
Capillarity.
Food-values.
Money.
The accusative-infinitive construction in Latin.
Construction of a mortice and tenon joint.

6. Select a pupil in school who fails to understand some process, *e.g.*, long division, simple equations, analysis of sentences, etc. Diagnose the cause of the difficulty with appropriate tests and apply remedial measures.
7. Devise suitable tests for estimating whether appreciation has resulted from a lesson (or course of lessons) in literature or music.

Books for Reference

FINDLAY : *Principles of Class Teaching.*
ADAMS : *Primer of Teaching.*
Exposition and Illustration in Teaching.
BAGLEY : *Craftsmanship in Teaching.*
FREELAND : *Modern Elementary School Practice.*
,, *The Improvement of Teaching.*
DEWEY : *How We Think.*
MILLER : *The Psychology of Thinking.*
HAYWARD : *The Lesson in Appreciation.*
CATTY : *Training in Appreciation.*

WESTAWAY: *Science Teaching.*
JAMES AND DIXON: *Creative Woodwork.*
PAULU AND COFFMAN: *Diagnostic Testing and Remedial Teaching.*
GREEN AND JORGENSEN: *The Use and Interpretation of Educational Tests.*
BROWN: *Teaching Science in School.*
ARMSTRONG: *Teaching of Scientific Method.*
ADAMS (Editor): *Educational Movements and Methods.* (Article on Heuristic Method.)
ADAMS: *Modern Developments in Educational Practice.*
VAN BUSKIRK AND SMITH: *The Science of Everyday Life.*
DEWEY: *Democracy and Education.*
,, *Schools of To-morrow.*
PARKHURST: *Education on the Dalton Plan.*
KIMMINS AND RENNIE: *The Triumph of the Dalton Plan.*
RUGG AND SCHUMAKER: *The Child-Centred School.*
STOCKTON: *Project Work in Education.*
STEVENSON: *The Project Method of Teaching.*
HOTCHKISS: *The Project Method in Classroom Work.*
BODE: *Modern Educational Theories.*
KILPATRICK: *Foundations of Method.*
COLLINGS: *Experiment with a Project Curriculum.*
CHARTERS: *Curriculum Construction.*
FLEXNER AND BACHMAN: *The Gary Schools. A General Account.*

SECTION VI

SOCIAL DEVELOPMENT AND ADJUSTMENT

CHAPTER XII

TRAINING IN SOCIAL ADJUSTMENT—TREATMENT OF BEHAVIOUR-PROBLEMS IN SCHOOL

So far we have considered intellectual development and the teacher's function in relation to it. We have now to consider an equally important aspect of development, namely, that of character and self-control.

Community-life presents a curious paradox. A social group must be composed of individuals. Each individual is endowed with strong desires and unconscious strivings, which he seeks to gratify often at the expense of other people's well-being. However, if unrestricted individualism is allowed, conflict within the social group becomes inevitable and life soon becomes "nasty, brutish, and short." An excellent example of this may be found on the highroads of the country now that they have become crowded with motor-vehicles. The paradox is this—the greatest possible degree of individual freedom can be obtained only if each individual controls his behaviour according to certain rules. Practical freedom implies self-restraint.

Even full intellectual development requires a highly organized social community. Hence we cannot in practice promote intellectual development without taking into account the social organization in which it flourishes.

Training in self-control and social co-operation is essential in school and classroom. Serious school-work becomes impossible if the classroom is the setting for frequent free-fights between the pupils. Efficient social training is an essential branch of education, since not only is the individual child enabled thereby to make the best use of his school life, but such training is a valuable preparation for the wider community life into which the pupil will be merged after his schooling has finished.

Hence, the teacher must take account of the processes of social training, because they are necessary both for a good school-organization and for the general community-life.

The practical educational problem can be stated quite briefly. It is this. Human nature is endowed with hungers and aversions which require satisfaction. Unlimited satisfaction is socially impossible or undesirable. What native propensities, then, are available to act as controls upon the drives of immediate self-seeking? Further, how can these controlling factors be developed by training and organized within the human personality?

In this chapter we shall take up these two aspects of the problem.

First we must prepare a 'behaviour balance-sheet' and analyse the controlling factors which can offset the drives of immediate self-seeking.

Secondly, we must consider how the controls can be organized.

One very important principle must be kept in mind throughout. The controlling factors must never be allowed to become so powerful as to destroy intelligent initiative and progressive adaptation to more efficient plans of social organization. We need to produce intelligent, responsible, socially minded persons, not slaves—even though they may be slaves only to a tradition. Hence we must include intellective factors in our 'behaviour balance-sheet.'

The analysis of the drives of human nature has been sketched in the chapters on motivation. What then are the controlling factors?

I. Psychological Factors in the Regulation of Behaviour

These factors may be divided into two broad classes: (*a*) non-intellective and (*b*) intellective.

NON-INTELLECTIVE FACTORS

Habituation

Any response if repeated frequently tends to become semi-automatic, and occurs whenever the appropriate stimulus is presented. Habits with a social reference, *e.g.*, habits of courtesy, possess the same advantages as any other habits. They require a minimum of conscious choice. They are easily performed. They follow the normal stimulus more or less invariably.

Hence the socially well-habituated person is most likely to

respond satisfactorily in an emergency. A child who habitually speaks the truth is not so likely to yield to a sudden temptation to lie, as one not so habituated.

Fear

The normal result of the fear-emotion is (*a*) to depress or prevent activity, or (*b*) to produce a flight from the fearful situation. This is true whether the object of the fear is physical punishment, or mental distress (such as is caused by loss of prestige or social ostracism).

However, while fear is a powerful regulatory factor, its influence is negative and not constructive. Fear may prevent undesirable actions, but it does not indicate more desirable alternatives. Therefore, by itself, it is not educationally valuable. We need to seek for regulative factors which promote constructive behaviour.

Primitive Passive Sympathy

A person tends to experience certain feelings or emotions, and to perform certain motor reactions, when he sees signs of these in other people. Spectators at an exciting football match often reproduce the movements made by the players—occasionally to the discomfort and annoyance of their immediate neighbours. A theatre audience will reproduce the facial expressions or the emotional moods portrayed by the actors. A sudden cry of terror arouses terror in the bystanders.

This propensity has been called by McDougall "primitive passive sympathy," and it is intensified by the presence of a crowd. The feelings and actions thus produced do not depend upon the deliberate purpose of the person in question. He may be quite unaware of the effects in himself.[1] The propensity is mainly responsible for the mass panic, rage, or stupid horse-play which occasionally infects a crowd who are, as individuals, normally sensible and sedate.

Hence it tends to induce in any one individual the type of behaviour characteristic of the crowd of which he is for the time being a member.

Self-abasement

This is a feeling experienced by the normal human being when in the presence of any object which seems superior, great, or grand,

[1] The rapt theatre-goer does not *realize* that he is smiling or frowning in company with the actor he is watching.

and *with which he tends to identify himself.* It is an essential component in humility, awe, reverence, admiration.

It is distinct from a feeling of inferiority in that the self-abasement is pleasurable. The person experiencing it tends to identify himself with the superior object and thereby becomes a part of its greatness. Note in this connexion the satisfaction of the devout religious worshipper and the attitude of the fanatical members of the Nazi, or Fascist parties. The 'Führer-principle,' so astutely popularized in the totalitarian states, is a more or less deliberate means of cultivating this feeling of self-abasement in the crowds of common people.

This self-abasement is a powerful factor in regulation, since it makes the person experiencing it particularly prone to the influence of imitation and suggestion.

Imitation and Suggestion

These two tendencies are very widespread both in the fact that all people possess them to some degree, and that they are important components in all learning-situations. Discussion of them has been included here because of their special importance as regulative factors, but they are equally important in many other branches of school-work.

Both terms are used very loosely and need careful definition.

Here 'imitation' will be used for the tendency of an individual to adopt as his own, and endeavour to repeat, either:

An action performed by another person, or

A result achieved by another person.

'Suggestion' has two common meanings not identical with its correct psychological usage:

(i) Associations.

The sight of a bottle of ink 'suggests' (*i.e.*, recalls to consciousness) such ideas as the name of well-known manufacturers of ink; pens and writing; filling a fountain pen; examinations.

(ii) Indications of procedure.

When a pupil is in difficulties a teacher may say; "Why not try this way of doing the problem?" or "You may find it quicker to use algebra than arithmetic." Here the object of the teacher's 'suggestions' is to call up relevant ideas not yet envisaged by the pupil, thereby indicating correct procedures.

Further, when 'suggestion' is used in this connexion it is implied that the indication given is not a command to be obeyed

without question, but a proposition to be considered by the pupil who may reject it if he pleases.

Suggestion properly so-called is a process of communication in which a proposition is accepted *with conviction, in the absence of any logical grounds* for the acceptance.[1]

The essential mark of suggestion is the acceptance with conviction in the absence of logical grounds. Hence the process plays an exceedingly important part in social conduct both for good and evil. All forms of propaganda are rich in suggestions, and they owe their success to this tendency to believe anything we are told, or read in print. If a newspaper asserts sufficiently strongly that all Russians have red hair, or that all Socialists are atheists, then thousands of people will believe these propositions with perfect conviction without ever having seen a single Russian, or ever having known a single Socialist, and without ever having demanded any kind of factual or logical evidence whatever concerning the truth or falsity of the propositions suggested.

Conditions favouring Imitation and Suggestion

It is important to note the conditions which favour imitation and suggestion. These tendencies are strongest when the actions, results, or propositions in question are:

- Frequently seen or heard.
- Performed or asserted by many people.
- Performed or asserted by persons with prestige, *i.e.*, persons in authority whom we admire, or trust, and with whom we identify ourselves (presence of feeling of self-abasement).
- Such as we are predisposed by our native endowment to favour.
- Likely to operate in the direction of our own advantage, individual or social.[2]
- Concerned with matters about which we have little or no certain knowledge.

A workman may be persuaded to believe the most illogical and even ridiculous propositions about the healing powers of a patent medicine or the virtues of the reigning government. But it is difficult

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[1] See McDougall, *Social Psychology*, Chapter IV.

[2] *Cf.* the extraordinary belief that an army of Russians had passed through England on their way to the battlefields in France in the autumn of 1914.

to persuade him that a machine which he helps to produce by the thousand at a cost of five shillings each is worth two guineas. Scientific people who would blush for shame if they uttered a proposition which was not strictly true and logical in their own subject, will sometimes believe without a qualm the most unscientific nonsense in other branches of knowledge.

It follows that children are peculiarly susceptible to suggestion in the early years of life.

Imitation and suggestion are most powerful factors in conventionalizing manners, customs, and ideas. They tend to mould the actions and thoughts of each individual to the patterns which prevail in the social group. They make for conformity, particularly in modern times when propaganda is spread by books, newspapers, wireless, and cinema performances. These influences are so strong that they are now a public danger. They can effectively prevent any departure, particularly in thought, from a standard pattern which is, only too often, mediocre or worse.

The 'w' or General Character-factor

In the chapter on transfer of training readers were introduced to the concept of aptitude-factors, general and specific. There we discussed *intellective* factors and noted the possibility of the presence of g, a general intellective factor. There is reason to believe in the possibility of *non-intellective* general factors of which the w or character-factor is an example.

In 1915, Webb applied the methods of correlation to the analysis of character and temperament traits.[1] He found a high degree of inter-correlation between the following set of traits:

Tendency to work with a distant objective in view.
Tendency *not* to abandon tasks from mere changeability.
Perseverance in face of obstacles.
Kindness on principle.
Trustworthiness.
Conscientiousness.

He also found a high degree of inter-correlation between

Tendency to quick oscillation between cheerfulness and depression (as opposed to permanence of mood).
Readiness to become angry.
Eagerness for admiration.
Self-esteem, particularly in the form of superciliousness.
Bodily activity in the pursuit of pleasure.

[1] See *British Journal of Psychology*, Monograph Supplement, III, 1915.

Moreover, the inter-correlations of traits in the first set, with traits in the second set were consistently low. This indicates that people who possess more than an average amount of any one of the first set of traits tends to possess more than an average amount of all the others in that set, but less than an average amount of the traits in the second set, and *vice versa*. The correlations were not materially altered when the influence of the *g* factor was eliminated.

Hence Webb concluded that there was a second general factor which he called *w* to distinguish it from *g*, of which it is independent. This *w* factor may be regarded as *persistence of motives*.

It is easy to see that this *w* factor or persistence of motives is a most valuable regulative factor in conduct. Social adaptation requires loyalty to a common policy even when that policy does not agree with our own immediate satisfactions. Hence, those people in whom the *w* factor endowment is strong will, other things being equal, be socially most stable. Having adopted a policy, they will be most likely to continue in it until the desired objective is achieved.

Different people seem to possess different amounts of the *w* factor, which implies that some people are natively more persistent and socially stable than others. This fact should be borne in mind when ascribing blame for lack of self-control and loyalty.

Hunger for Self-enhancement

The description of this native hunger given in Chapter IV will indicate its rôle in social regulation.

For full satisfaction it needs a social environment. We desire to be at least equal, and if possible superior, to our neighbours. Hence we seek to do things which will be acknowledged publicly to be meritorious. Therefore the hunger stimulates each individual to strive to attain at least a minimum standard of conduct. Also, the conduct must of necessity be such as is socially acceptable in the group of which we happen to be members. Thus the hunger tends to foster conformity to the accepted social ideals of the group.

We must note, of course, that the *quality* of the conduct determined by the hunger for self-enhancement will depend upon the standards of value accepted by the group. In a group of thieves, approbation will be gained by superlative thieving, just as in a group of honest men, approbation will be gained by super-

lative honesty. This makes no difference, however, to the strength of the propensity for *promoting group-solidarity and conformity to group-standards* at the expense of individual whims, and in no way affects its value as a factor in social regulation.

In connexion with the social training of children it is very important to note the connexion between this hunger for self-enhancement, and the sentiment of self-respect. The discussion of this relation will be taken up in later sections.

INTELLECTIVE FACTORS IN REGULATION

Apprehension of Psychological Relations: The Natural Basis for the Notion of Fair Play

One powerful regulative factor is the ability to 'put ourselves in the place of others' and estimate their experiences. This can be done partly through the operation of primitive passive sympathy. Yet this is too crude a process for a high degree of social civilization. We require a more critical adaptable ability. This may be found in the ability to apprehend psychological relations. The nature of this ability can be estimated from the following considerations.

Each person's feelings and emotions are private to himself. We can estimate another person's feelings and emotions only indirectly by a process of educing relations and correlates. When we are angry, fearful, hopeful, satisfied, we can recognize the experience within ourselves. We also note that each feeling or emotion tends to produce in us certain correlated appearances and reactions. We can observe similar appearances and reactions in other people. We apply the relations between reactions and experiences in our own consciousness and then infer what the other people are probably experiencing.

Thus we may note two people, red in the face, shouting insulting remarks at each other, and gesticulating pugnaciously. We know that if we ourselves show this kind of behaviour we usually feel angry. Therefore we infer that the two people in question are feeling angry.

It is an interesting exercise to present to children (or adults) a picture showing some situation having feeling and emotional values and ask them to interpret it. This forms one of the tests in the well-known Binet intelligence scale.[1]

With this ability, it is possible to obtain some insight into the train of ideas which is uppermost in the mind of another person, and to anticipate his probable future actions and needs.

[1] See also Spearman, *Abilities of Man*, p. 180.

It is not suggested that our apprehension of psychological relations and eduction of correlates is always accurate and adequate, any more than any other branch of observation and inference. Different people possess the ability in widely varying degrees, and employ it with varying skill. Nevertheless this ability does enable us to construct an approximate mental picture of the psychological processes of our neighbours. For this reason it can play an extremely important part in social regulation and moral conduct. In particular, it seems to provide the basis for tact, and the elementary notion of fair play—doing to others as we would like them to do to ourselves—which is the beginning of the concepts of equity and justice.

As such, it is a very necessary factor in *self*-regulation. It enters into *altruism, i.e.*, conduct determined solely by regard for the welfare of others. At an elementary level of social development we may act in a way which is eminently satisfactory to ourselves, but which produces in other people expressions of anger, fear, pain, disappointment, sorrow. We infer their feelings from their expressions, and by reference to our own consciousness realize their experiences, and their probable attitude to ourselves and our conduct. We may find the reconstruction so repugnant that we cease to pursue that line of conduct. At a higher level we think out a line of conduct in advance of performance, estimate its probable effects on the well-being of other people, anticipate their approbation or criticism, and modify our actual conduct accordingly. The ability to estimate the psychological condition of other people enables us to make constructive efforts for the amelioration of social injustice.

Finally, we have the processes of observation, comparison, contrast, reflection, abstraction, generalization which, applied to the data of conduct, enable us to *formulate principles of conduct and apply them to everyday life.*

II. Sentiments and the Organization of Character

We have thus briefly outlined the regulative side of the 'behaviour balance-sheet.' It appears that, in addition to the primitive hungers and aversions which drive us to some form of self-satisfaction and assertion, we are also endowed with traits which curb our self-assertion or which direct it into channels in conformity with social custom and convenience.

As in the case of the hungers and aversions, these regulative factors seldom if ever occur singly. The total regulating force consists in a complex resultant of some or all of these factors working together. Our next problem is to discover how the regulative factors can be organized within the personality in such

a way that effective self-control becomes habitual, but does not prevent progressive adaptation to higher levels of social conduct. The answer to this second problem will be found in sentiment-formation and the organization of character.

MEANING OF CHARACTER

It is often necessary to be able to describe an individual and estimate his suitability for some position, *e.g.*, a teaching-post. In such a case we should be interested in *physical* traits (height, health, endurance, motor-dexterity); *intellectual* traits (ability to learn, originality, powers of logical analysis); *temperamental* traits (quickness to anger, courage, cheerfulness, sociability); and, particularly if we required a teacher of literature or art, we should inquire about *æsthetic* traits (good taste).

There is, however, yet another set of traits important for any position of responsibility, namely, *character* traits, *e.g.*, industry, trustworthiness, capacity for loyalty, ability to resist temptation. These all rest upon a fundamental tendency to persistence of conduct.

We may describe character from a psychological point of view as the control over his conduct manifested by any given individual. Hence character varies between strong and weak. 'Good' and 'bad' do not apply to character as the factor of control, but rather to the social and moral value of the ends towards which the control operates.

SENTIMENTS

Social conduct implies the resolution of a conflict between at least two opposing conative factors in the personality. On the one side there is an urge to some kind of self-satisfaction. On the other side is an urge to obey a public rule incompatible with complete self-satisfaction.

Consider a simple case concerned with punctuality at school. It is a fine warm summer afternoon. Two boys are on their way to school. The bright warm sun and freedom of the open air give them pleasure. School by contrast is a tiresome place, and the first lesson is arithmetic, which they both dislike. The aversion for arithmetic reinforces the attraction of the open air. Their pace is slow. Suddenly a bright-coloured butterfly appears. They want to catch it, and start off in pursuit in a direction away from school. Then they hear the warning bell in the distance and realize that if they follow the butterfly

they will be late at school. They know that all late-comers are punished. They are averse to punishment, having experienced its effects on previous occasions.

Thus a conflict is staged within them. Their desire for the pleasant open air and the butterfly drives them away from school. Their aversion to punishment for being late drives them towards it. They hesitate. If the aversion to punishment is stronger, they will then hurry to school and avoid it.

This is a comparatively simple case. Often the conflict is more complex. The boys may admire and respect the teacher, although they are not particularly fond of the subject. They know that they will get no painful corporal punishment even if they are late. But they realize that by going late into the classroom they will disturb the class and interrupt the teacher. They desire to stand well in his estimation, and therefore his disapproval of their unpunctuality is unpleasant. In addition they respect their parents, prefering their approval to their blame. They know their parents do not approve if they are unpunctual. In this case respect for teacher and parents and a preference for their approval are opposed to the temptation to loiter. If the respect is strong the conative factors organized within it (*i.e.*, desire for approval, desire to avoid the humiliation of blame) will overcome the desires to keep out of school and away from the arithmetic.

In both these instances we have examples of the operation of *sentiments.* We owe to A. F. Shand [1] and Professor McDougall [2] the recognition of the importance of sentiments in moral development, and a detailed analysis of their organization and function.

The conative tendencies of the young baby are at first chaotic. They lack any marked direction. As experience is enlarged, however, the baby begins to strive for specified objects or purposes. He acquires definite desires and aversions. He strives towards and associates pleasure with certain kinds of food, toys, people, and situations. He strives away from and associates displeasure with other foods, toys, and people. These definite likes and dislikes *become habitual.* They are the sentiments.

A sentiment may be defined as *an acquired association between cognitive and conative mental elements.* More popularly speaking, we may say that they are acquired associations between objects or ideas, and drives.

Sentiments are a class of habits. We have already noted a class of habits which involve association of ideas (*e.g.*, we think of 'ink' and immediately think of 'pen,' or 'blot' or 'black'). We have

[1] *Foundations of Character.* [2] *Social Psychology.*

also noted the class of motor habits which involve association of movements (*e.g.*, We take up a pen to write our signature. We make the first letter and the movements for making each succeeding letter follow in smooth effortless co-ordination). We can also distinguish an ideo-motor class of habits in which some perception (or idea) is immediately and invariably followed by a movement (*e.g.*, a private soldier sees an officer and salutes; we think of a word and write it down). The sentiment (or character habit) is different from the other types just noted in that *one of its components is always some form of striving, together with feelings of pleasure or unpleasure.* The presence of a sentiment therefore implies an attitude toward things, people, ideas, and ideals.

The organization of sentiments stabilizes and directs the conative and effective elements of the personality (drives, emotions, feelings); leads to the formation of character; and determines social conduct.

Sentiments may be of two kinds—likes and dislikes—which develop into loves and hates (using the terms with a broad meaning). Each person acquires simple sentiments for various individual things, people, and activities. School-children develop likings for toffee, for their pets, for father and mother, for a favourite uncle, for their teacher, for football. They may develop dislikes for medicines, for the dentist, for big dogs, for men with black faces (negroes or chimney-sweeps), for home-work.

SOCIAL AND MORAL SENTIMENTS

The great importance of sentiments for social development lies in the fact that the cognitive element which is the object of the liking or aversion may be *a rule of conduct and the activities implied by it.* Such sentiments (which we may call for convenience, social and moral sentiments) usually begin as likings or aversions for particular *people* and *institutions.* Once formed the sentiment is capable of very great increase in range and complexity.

A boy acquires a love for his father. In the boy's estimation his father is big, strong, clever, influential. He feels a receptive, self-abasive attitude towards the father. His hunger for self-enhancement is directed towards the father-conditions. The boy wishes to be like, and do like the father. He begins to imitate the father, and is open to suggestions from him. By association with the father as an admired individual the boy adopts the man's attitudes, his type of conduct, his ideas, and ideals.

On the conative side, several motives, emotions, and feelings are organized into a system with respect to the father-image. If the father succeeds, or is praised, the boy is elated because, *as he has identified himself with the father*, his own hunger for self-enhancement is satisfied. He boasts about his father to his schoolmates. If his father is criticized or belittled he feels disappointment and distress. His anger and pugnacity are aroused. He will be ready to fight in defence of his hero's reputation. He is elated by praise from his father, and distressed by his disapproval. Therefore he strives to excel in any conduct which will earn the praise, and to avoid what brings the disapproval.

Similarly, the boy may dislike and later hate the father. In this case he is critical. He strives to be different. He strives to excel in what will cause the father's displeasure. He scorns the man's attitudes and ideas and strives to prove them wrong. He is elated when the father fails, or is criticized and humiliated.

Instead of a parent, the cognitive element of a social sentiment may be an institution—school, church, social club, scout patrol.

In many people, perhaps a majority, the elaboration of the cognitive elements in their sentiments remains at this anthropomorphic level. Their standards are those of parents, teachers, school or social set. Their conduct is limited by what their friends believe to be the correct things to do, or think, in any given circumstances.

It is possible, however, given the necessary powers of abstraction, that the adolescent may begin to dissociate a given line of conduct from the human model who embodies it. He may begin to elaborate explicitly a principle of right conduct and consider the practical and theoretical reasons for its rightness. In so far as this advance takes place, *the original constellation of conative elements becomes associated with abstract principles of conduct* and the individual concerned is influenced to a diminishing extent by mere accidental circumstances of time and place. He will endeavour not merely to perform what is considered a just act in this or that particular situation or social environment, but to make all his actions conform to a principle of justice irrespective of local standards.

MASTER-SENTIMENTS

It often happens that a person's conduct is determined by a number of separately organized sentiments, the cognitive elements

of which have little or no inter-connexion. In such a case, his attitudes, standards, and conduct will differ according to the particular circumstances of the moment. In his family circle his conduct will be typical of the home standards. At church he will do and think what the church officials approve. In business his morality will be that of his business associates. His principles are gathered in 'logic-tight' compartments as it were, with little or no recognized connexions.

In other cases, however, one single sentiment gains complete control and dominates the personality. These *master-sentiments* may be love or hate of some person, object, institution. The dominating motive may be avarice, sexual love, jealousy, revenge, domination, vanity, or the craving for some special reputation, *e.g.*, as scholar, poet, statesman, soldier, athlete, wit, or 'man of the world.' Under the influence of a master-sentiment the whole of a person's conduct is directed towards the one absorbing purpose. The development of a master-sentiment in a person's life and its influence upon his career is a favourite theme for novelists since the sentiment may drive its possessor to greatness or to tragedy. When the cognitive element in the master-sentiment is an abstract principle of justice, beauty, or humanity, the person concerned may become a valuable agent for promoting the public good.

One master-sentiment is particularly important in social and moral development. This is the *self-sentiment*. In this, the cognitive element is some idealized image of the person's self—himself as he believes he is, or as he wishes to be. The pre-adult history of most people is a series of episodes in hero-worship. The child begins by admiring, and moulding his conduct in imitation of parents or relatives. Later, his models may be senior pupils in the same school, and then contemporary 'stars' in cricket, football, athletics, or films. As he reads in history and fiction he finds other heroes to be worshipped and imitated. The younger child is quite happy to worship his heroes, each for a short time, without considering the implications of copying each one. During adolescence, however, when the necessity for choosing some definite career arrives, he finds he cannot become like all his heroes at once. If he copies one he may have to discard another, since their lives, activities, and standards may be incompatible with one another, and with his own temperament, abilities, and material resources. Usually then the adolescent abstracts from this or that heroic model some aspect which he finds particularly attractive,

and he builds up a composite image of an ideal self—the self he would like to be.

If this ideal self is at all clearly envisaged, it commands the respect of the growing boy or girl and becomes a positive aim to be achieved. It sets a standard by which present thoughts and conduct are measured and valued. This is what we mean by self-respect. The self-image stands apart from the actual self in the youth's imagination and becomes a silent spectator watching and appraising each act as it is performed. Hence, in social and moral training, we should make every possible effort to encourage the development of a sane and worthy self-image which will be the object of respect. When this self-respect is well-organized, the pupil may safely be left to work out his subsequent career independently. He will have reached full social and moral stature, since by that time he will be strongly motivated towards such conduct as the silent spectator—the ideal self which is always present in the conscious or subconscious mental background—will approve. The approval or disapproval of this silent spectator is what we know as conscience.

It should be noted that the self-sentiment is only one of a number of possible master-sentiments.

COMPLEXES

The term 'complex' like the term 'instinct' has caught popular attention. It was used frequently by the psycho-analysts, and when their more spectacular conceptions became 'news' the term was bandied about by journalists, novelists, preachers with 'advanced' views, *et hoc genus omne*, until it became as devoid of meaning as 'stupendous' and 'amazing' when these are used in the advance notices of cinema films and in 'best-sellers.'

However, correctly used, the term 'complex' has a definite psychological meaning, and the mental system which it signifies plays an important part in social development.

To understand the meaning of 'complex' we must refer to two points already touched upon previously. In the first place we have described a sentiment as an acquired association between cognitive and conative elements. In the second place we have noted Freud's doctrine of forgetting.

Freud emphasized the fact that the experiences which were most frequently repressed into the 'unconscious' mental layer, were such as we would be happy to forget, experiences, that is, which *humiliated*

us and *wounded our self-esteem,* in other words, which were in conflict with the established self-image.[1]

Now, since one part of any sentiment is cognitive, it is therefore governed by the rules of forgetting. Suppose the cognitive element (the idea-aspect) of the sentiment is humiliating and is repressed into the unconscious level beyond voluntary recall. *What happens to the conative part of the association ?* Does it thereby lose its power of influencing conduct ?

The answer seems to be a definite ' no.' Many cases have been described by medical psychologists in which strong motives appear to dominate the conduct of the patient, but of which the patient himself is completely unaware. It seems at first sight rather ridiculous to assert that any normally intelligent person could possibly be influenced by motives he does not suspect. The situation is rather common, however. We all have prejudices and although they influence our thoughts and conduct to a marked degree, we seldom realize their presence in ourselves, however apparent they may be to other people.

A complex, in the correct psychological meaning of the term, is a sentiment, *the cognitive element of which has been repressed* and cannot, voluntarily, be recalled. Complex-formation is damaging to character. By the very nature of the case it leads to instability, since the person is driven to acts and attitudes in conflict with his conscious personality, which he is quite at a loss to explain, and over which he has little deliberate control.

Usually, when a person displays, with regard to some particular aspect of his environment, an attitude strongly at variance with his normal personality, particularly if it is accompanied by signs of irrational anger or fear, we may suspect the activity of a complex.

Thus, sentiments are the *functional units* out of which character develops. They combine the stability and momentum of habit with the flexibility of intellectual principles. It is clear, however, that character is more than a bundle of sentiments. For full character-development the various elementary sentiments must be related through their cognitive aspects in a co-ordinated system. Only when this happens will the conduct of the individual be thoroughly consistent throughout all the varying situations of everyday life. Thus full character-development must be reached through the development of a single master-sentiment. The most

[1] See p. 276.

effective master-sentiment for full social and moral development is a sentiment of self-respect within which is incorporated a sound system of ethical principles.

It follows from this that transfer of the effects of training is essential for full moral stature. School- and home-training cannot possibly cover all the particular situations which a given pupil will encounter during his life. In the absence of transfer, the pupil, and later the adult, will behave correctly in situations identical with or similar to those in which he has been trained, but he may fail miserably in a situation which he does not recognize as being similar to his training situations. Thus we find people who will indignantly repudiate the temptation to rob a neighbour, but who will quite cheerfully rob a foreigner, or a railway company.

Hence in social and moral training it is necessary to keep in view the necessity for transfer and to teach in such a way that the greatest possible amount of transfer is facilitated.

III. Practical Aspects of Social Training and School-government

The principles discussed in the previous sections indicate procedures to be adopted in the practical everyday work of social training and school-government. These can be grouped conveniently into three sections :

Procedures for sentiment organization.
Procedures for dealing with social offences.
Special cases.

SENTIMENT-ORGANIZATION

Social development implies self-subordination to customary (or ideal) rules of conduct. Therefore our first and principal aim must be to organize in the pupils strongly welded sentiments of liking for conduct according to socially desirable rules (actual or ideal), and of aversion for conduct at variance with such rules. How can these sentiments be organized ?

In the process of organization we must make use of the psychological factors indicated in Section I of this chapter.

The first phase must be the formation of sentiments for particular people and concrete institutions (home, school, church) which embody the desirable conduct. In school, the pupils will begin by respecting and admiring teachers and senior pupils whose attitudes and conduct they will then imitate and whose opinions

they will accept (operation of primitive passive sympathy, self-abasement, imitation, suggestion, and hunger for self-enhancement).

The school- and classroom-organization must ensure that socially-desirable conduct is *invariably* followed by pleasurable consequences, and undesirable conduct by unpleasurable consequences.

Since mass-influence is such an important factor in regulation, the organization of sound conventions and a healthy school-'tone' is essential for the early stages of sentiment-formation. If the majority of the pupils (and the natural leaders in particular) conform happily to the rules, incoming pupils will adapt themselves quickly to the prevailing tone of the school-society, and find it difficult and unpleasant to act in a contrary fashion.

The influence of the school-staff and senior pupils can be strengthened and broadened by judicious selection of material for pupils' reading in history and literature. Good biographical material is particularly valuable.

SCHOOL-CELEBRATIONS AS AIDS TO SENTIMENT-FORMATION

If the social influence of the school is to be strong, the child *must identify himself with the school as a group-organization.* This group-solidarity is emphasized by the use of ceremonial occasions. We may note particularly:

- Daily assembly, prayers, community singing.
- Special school-celebrations—Founder's Day, Armistice Day, Empire Day, etc.
- Celebrations in honour of local or national personalities, *e.g.*, noted public servants, musicians, artists, authors, scholars.
- Athletic meetings. Massed physical exercises performed in unison. Folk-dance festivals. Eisteddfodau.

To be effective the ceremonial must be (*a*) well organized; (*b*) impressive; (*c*) directed clearly, and within the comprehension of the child, towards the desirable object, or ideal. The effect of the impressive ceremonial is *to arouse awe in the participants,* and then to direct the emotional elements of all the assembled pupils towards the same object or ideal *at the same time.* By the action of primitive passive sympathy, the emotional and feeling elements aroused in each pupil are intensified by the collective activities. Each individual feels as if he were, for the time being, caught up and merged into a single large and powerful group motivated by a single purpose.

This unification may be emphasized by such devices as school-colours, school-uniform, school coat-of-arms, a happily chosen slogan or motto.

SELF-GOVERNMENT AS A FACTOR IN SENTIMENT-FORMATION

It is important that pupils, even young pupils, should be given opportunities for proposing new rules, or modifying existing ones. It is not suggested that pupils should direct the organization and policy of the school. They are obviously not competent to do so. Nevertheless, many opportunities arise in normal classroom-practice when the children can be called together to discuss a simple situation. The circumstances of the case can be put before them, comments and propositions invited, and a consensus of opinion taken. The organization and management of a class-library, keeping the classroom clean and tidy, treatment of books and apparatus, conduct of school meals, are examples of situations for which pupils may be allowed to formulate rules. Such rules are felt by the pupils to belong to themselves to a much greater extent than is possible in the case of rules superimposed from above in an apparently arbitrary manner. Thus the pupils more easily identify themselves with the rules and feel it a matter of honour to obey them. Moreover, discussions of simple cases bring home the necessity and the practical social values of rules and of right conduct.

When rules are formulated, they must be enforced impartially and no exceptions allowed. If the rules are administered with slackness, and arbitrary exceptions allowed, the *habits of conformity* will be difficult to establish.

At all times pupils should be treated as *persons*. They should be allowed to exercise responsibility in such matters as they are competent to deal with, and expected to assume such responsibility. They should be encouraged at an early age to develop a sane self-respect. To this end they should be treated with the respect and courtesy which is their due. Self-respect is the essential element in social and moral independence.

It is not desirable and indeed not necessary in the earlier stages to discuss social situations for the sake of discussion. This procedure tends to produce either boredom or priggishness. Concrete instances of right and wrong social conduct arise normally in everyday life sufficiently often to provide the necessary material for discussion of problems of conduct. The cases arising thus can

be supplemented by others from history and literature encountered in the course of normal school-studies.

During the first phase of sentiment-formation, the conceptions of right conduct will be derived from these concrete particular models by the operation of imitation and suggestion. The social regulation will be secured mainly by the operation of fear (in some degree), primitive passive sympathy, imitation, suggestion, hunger for self-enhancement, and habituation.

In the second phase of sentiment-formation the cognitive aspects of the sentiments will be broadened and generalized by the critical consideration of cases of right and wrong conduct, and the explicit realization of principles of conduct and their social necessity. As logical considerations increase in importance so should imitation and suggestion decrease, although these two factors will always continue to operate in some degree. Together with the refinement and generalization of the cognitive elements in the sentiments will go a change in the relative importance of the regulative factors, the non-intellective factors giving place more and more to the apprehension of psychological relations and eduction of the corresponding correlates, together with increasing appreciation of the social necessity of right conduct. This latter is itself a case of eduction of relations.

Generally speaking, the second phase is accelerated and approaches maturity during adolescence.

LIMITS OF SENTIMENT-DEVELOPMENT

It is important to note the limits of sentiment-development. These limits will be determined by the native intellectual powers of the pupil so far as the principles of conduct are concerned; by the native endowment of the *w* factor; and by the native strength of the propensities to primitive passive sympathy, imitation, and suggestion.

There will be as wide differences in social development between individual pupils as there are in physical and temperamental development. The formation of a strong stable character will be more easily accomplished by pupils well endowed with the *w* factor, than in pupils who lack this endowment.

This point should be kept in mind when considering the merits and demerits of some particular pupil, and in apportioning penalties. Also, *since many pupils cannot develop beyond the stage of regulation by social convention, it is essential to organize a set of stable con-*

ventions embodying sound social conduct. In a too-free conventionless society many people are bound to fail because they have not sufficient knowledge and intellectual ability to determine their conduct by reference to abstract principles. They are rather like ships without rudders.

TREATMENT OF SOCIAL OFFENCES

The rules with which the school is concerned mainly are :

Rules relating to public order.

E.g., conduct in classrooms, laboratories, dormitories (in boarding-schools), corridors, and school-premises generally ; punctuality, etc.

Rules relating to the teacher's office.

E.g., obedience to instructions and suggestions concerning academic work.

Rules relating to pupils' personal liberty of action.

E.g., rules of mutual courtesy, rules against bullying.

Rules relating to public and private property.

E.g., treatment of school-buildings, books, apparatus, articles belonging to fellow-pupils.

Rules relating to standards of work.

E.g., neatness, accuracy, quantity of work done, thoroughness, sincerity (pupils' own work must be presented, not copies 'cribbed' from other sources).

Rules relating to truthfulness, 'sneaking,' theft.

Types of Offences

In judging and treating offences it is essential that the particular nature of the offence be realized explicitly both by teacher and pupil. The aim of the treatment must be deterrent and *remedial.* The treatment should discourage the pupil from repeating the offence, but it is of much greater importance that the *causes* of the offence should be analysed and as far as possible removed. Good remedial treatment prevents the repetition of an offence by *removing the desire to commit it.*

There are two main types of offences : (*a*) breaking the rules ; (*b*) unwilling obedience to rules.

Offences arise from the following causes :

(i) Ignorance of the rules.

(ii) Excessive caution—pupils may fear to do right because they believe they will be doing wrong.

(iii) Physical or mental ill-health.

E.g., excessive fatigue, boredom, physical defect, after-effect of illness, complex-formation leading to inner conflict and compulsion.

(iv) Carelessness.

E.g., lack of attention, forgetfulness, insufficient self-control due to extremely quick reaction tendencies.

(v) Complacence.

E.g., failure to accept a sufficiently high standard of conduct due to former habits, bad home influence, bad teaching.

Knowing the correct standards, but failing through indolence or apathy.

(vi) Deliberate intent.

This class includes several sub-classes :

(*a*) In order to satisfy some otherwise legitimate interest incompatible with keeping the rule (*e.g.*, going for a country walk instead of to school).

(*b*) To gain unfair personal advantage.

(*c*) To signify superiority to the rules and the persons who make them.

(*d*) To express feelings of injustice and repression—as a protest against unfair rules or unfair administration of them.

(*e*) To express feelings of resentment against persons responsible for the rules.

Each type of offence needs its own kind of treatment. Some very brief indications of treatment are suggested below.

In Cases of Ignorance

Many offences, particularly among younger pupils arise through ignorance of, or wrong interpretation of, rules. This may be overcome by :

(*a*) Making as few rules as possible.

(*b*) Calling specific attention to the rules and *making sure by questioning that they are understood by all the pupils.*

(*c*) Posting rules in some prominent position where they may be read by all able to read, and calling attention to the place.

(*d*) Explaining as simply as possible the necessity for the rules.

In this connexion readers should refer to the sections on inattention

and partial attention, since these factors operate with regard to rules of conduct as well as to academic learning. Because a rule has been announced to a class, it does not follow therefore that all the pupils have *explicitly noted* it, or have understood its purport.

In Cases of Excessive Caution

This usually occurs in nervous, diffident, anxious children, particularly if they have been severely punished at home or at school for an offence committed through ignorance or carelessness. Here we must first make clear to the pupils that they will *not* be punished for any offence committed in ignorance. Usually in these cases, the feeling of confidence in the teacher's sympathy and fairness will remove the difficulty. During the first stages of the treatment they may be encouraged to seek the teacher's advice when they are in doubt about what to do in a particular case. Later, they must be encouraged to act upon their own initiative, and given some responsibility within their competence. These pupils are usually only too willing to do what is right if they can make up their minds to risk it.

In Cases of Physical or Mental Ill-health

Signs of illness, physical defect, lassitude, after-effects of disease are usually sufficiently apparent to teachers willing to look for them. One is helped in these cases by knowledge of pupils' home-circumstances.

Complex-formation has been discussed briefly. The usual sign is some compulsive action at variance with the normal character, particularly if the action is accompanied by abnormal signs of anger or fear. In simple cases, knowing something about the pupil's history, home-circumstances, and temperament may suggest a treatment. Bad cases need to be referred to the nearest expert medical psychologist (if one is available). Much useful information about this class of cases may be obtained in Dr Burt's *The Young Delinquent*.

In Cases of Carelessness

Offences due to lack of attention to rules may be treated by calling specific attention to all rules which concern the pupils. The habitually careless pupils should be singled out for special treatment. One can go through the rules with them, requiring some definite response to show whether or not they have grasped

the essential points. With younger pupils it is often effective to arrange a rehearsal of the correct conduct as a form of play. Breaches of rules may be prevented by reminding the careless, forgetful ones beforehand, so that they may anticipate the situation and have the correct actions in mind. They may be put to work with a group of steady pupils.

If these measures do not suffice, penalties must be awarded—extra work, less play, temporary removal of privileges, or making good the bad effects of thoughtless conduct. It is essential that correct habits should be established in these pupils as quickly and firmly as possible. Therefore we must try to *prevent any lapses.* In building up habits, one relapse may be as unfortunate as dropping a ball of string while winding it up. A great deal of previous work may be undone.

In the case of 'explosive' motor types of children, no sooner does an idea present itself to their consciousness than it is translated into action, no matter how unfortunate the consequences may be. In these cases it is necessary frequently to call attention to consequences, and encourage the habit of anticipating what is likely to happen, particularly the effects of the conduct on other people. Penalties may have to be imposed for thoughtless acts, and where practicable, the thoughtless pupils should be made to bear the consequences of their lack of due caution.

In Cases of Complacence

Where this is due to indolence, incentives must be organized to reinforce the motives leading to correct action. For suggestions refer to the section on organizing incentives (p. 126).

Where low standards are accepted on account of previous training, some explanation of the reasons why such standards are not acceptable must be attempted, and the acceptable standards made clear.

A case in point occurred in a school in a London slum district. The teacher wanted some bulbs to brighten up the classroom. He produced a half-crown and asked one of his pupils to buy some from a neighbouring shop. Immediately a bright lad who was standing near said, "Please sir, don't give him any money for them. I can 'pinch' as many as you want." This boy's offer was made genuinely to help his friend the teacher. It pained him to think of the teacher wasting good money on bulbs when they could be 'pinched' for nothing. The boy's intentions were quite laudable. He was merely acting on the standards ingrained in him by his home-surroundings.

In Cases of Deliberate Intent

In cases arising under sub-classes (vi) (*a*), (*b*), (*c*),[1] a quiet talk with the individual pupil concerned is indicated first. In this the aim should be, without preaching or 'moralizing,' to make clear the nature of the offence to the pupil, and explain the need for obeying the rules, emphasizing especially the *social* necessity for rules. Without obedience to certain necessary rules any corporate life is impossible, and therefore the pupil's own freedom of action is being curtailed indirectly by his disobedience. If approached tactfully and without bluster, pupils will often talk, and from this one may gather what their motives were, and modify the treatment accordingly.

When penalties must be imposed they should as far as possible fit the crime.

In cases of sub-class (vi) (*d*) a talk with the pupil will usually reveal the cause for the feeling of injustice and the motive for the revolt. If the feeling arises from misunderstanding, an explanation may clear it up successfully and remove the resentment. If there is good ground for the feeling then the only course is to modify the rule or its administration. Pupils in this class are quite often the most intelligent, upright, and enterprising members of the school-community.

Cases of sub-class (vi) (*e*) frequently occur on account of temperamental clashes between pupils and teacher. This cause is indicated when a pupil is normally well behaved but 'falls out' continually with one particular teacher. It is difficult for either teacher or pupil to view the situation reasonably. Each sets the other's teeth on edge, as it were. Such difficulties can be settled only by the friendly mediation of a third party, headmaster, or another teacher. If such mediation proves fruitless it may be necessary to remove the pupil, if this is possible, to another class.

SPECIAL CASES

If the school-tone is sound, the teachers sympathetic and competent, and the work stimulating, the majority of the pupils will adjust themselves to the social and academic activities happily, without much difficulty. Unfortunately, there exists a minority of pupils who seem incapable of making the necessary adjustments—the 'problem' children, as they are sometimes called.

[1] p. 374.

These need special treatment and should be cases for trained medical psychologists. Since only a comparatively few schools enjoy the services of such an expert, teachers may have to do what they can to solve any problem cases they meet. Here we can indicate only general lines of treatment and refer readers to special treatises on maladjustment and mental hygiene.

The essential condition for good adjustment is harmony within the personality between the motives for some type of self-assertion, and the motives for conformity with rules (actual or ideal). These factors have already been indicated in this chapter. Now, observation shows extensive differences between individuals with respect to intelligence, persistence of motives and moods, quickness to anger, excitability, quickness and intensity of motor response, and degree of intensity of the primary hungers. If, therefore, an individual is endowed with moderate or low persistence, moderate or low intelligence together with an excessive craving in some particular direction, it follows that it will be difficult for that individual to achieve the balance of motive favourable to social conduct. Some normal children are turned into problem cases by persistent bad management at home or at school. The majority of the problem cases arise primarily from poor or unequal endowment.

In cases of lack of intelligence, which implies faulty social judgment and inability to connect cause and effect, the pupil is not capable of adjustment to any complicated, changing environment. The only satisfactory treatment for these cases is sympathetic supervision, and an attempt to create a simple and stable environment.

In cases where lack of persistence and a tendency to quick oscillation between elation and depression are the dominant characteristics, the pupil must be kept as far as possible from sudden environmental changes, and from temptation in the form of counter-attractions to the task in hand, and incentives organized to reinforce the faulty persistence.

In cases where the difficulties arise from excessive craving for satisfaction there are two general lines of treatment depending upon the causes at work in each case. Excessive craving may arise in persons normally endowed with the primary hungers if they are persistently starved and therefore lack satisfaction. In these cases, any effective treatment must begin with the provision of opportunities for normal satisfaction of the hunger. On the other hand, when the maladjustment is caused by genuinely excessive endow-

ment and direct satisfaction is undesirable, the energy represented by the hunger must be *sublimated*, that is, diverted into socially acceptable channels which provide a substitute satisfaction. Concrete examples will make the principles of treatment clearer.

Cases of Excessive Craving arising from Deprivation

General malnutrition due to poverty causes hunger pangs and desire for food (at least in its early stages). Desire for satisfaction may lead to thefts of food, or of money to buy food. More subtle cases arise from badly balanced diets. If their diet contains insufficient amounts of sugar, milk, and fruit, many children will suffer from a persistent craving for these articles of diet. This leads frequently to petty thefts of sugar, milk, and fruit. Supplies in the pantry, local orchards, shops, and fellow pupils' pockets or desks may be raided. Exhortation and punishment cannot effect a permanent cure. If the craving is intense, the children will carry on their raids surreptitiously, deceit and lying being added to the already existing offence. The cure must begin with an improvement in the diet.

Craving for success and social popularity may lead to many offences varying from upsetting the class-order to wild schoolboy pranks involving damage to property. This frequently occurs in robust high-spirited children who are neglected or repressed at home, and are at the same time not clever at school-work. The treatment must aim at providing chances of success *and public recognition* in desirable activities. In addition, an attempt must be made to remove the offender from the environment in which mischief is admired and praised, to one in which sounder values hold. Scout-troups and boys' clubs are very valuable organizations in this connexion.

Similar treatment is indicated for cases of excessive desire to 'show off.' Opportunities for such children to 'shine' may be provided in school-debates, mock elections, concerts, and plays. Some girls of this type find great enjoyment and often show much ingenuity and enterprise in making and displaying fancy dress and costumes for amateur theatricals.

One occasionally hears an exasperated teacher, at the end of his forbearance, turn to a persistent offender and say, "You are quite the worst pupil in the class." This is a fatal error in tactics. To be the worst in the class may represent a valuable position of eminence. To have it publicly acknowledged gives the offender a

secure reputation in the eyes of his fellow pupils which he will do his utmost to maintain. It provides the elation which he cannot gain by any other means.

We must avoid competitions in wrong-doing. It is wiser to try to provide the persistent offender with some legitimate work in which he can be successful. He will not then crave so insistently the elation of wrong-doing. In any case successful disobedience need not be publicly advertised by the teacher.

Cases have been reported of children from poorer homes, who have secured scholarships to schools where the majority of the pupils enjoyed more affluent circumstances. Craving equality with the more well-to-do pupils they have stolen money or clothes. In other cases the parents were sufficiently well-to-do, but for some reason deprived their children of pocket-money. Sometimes tactful education of the parents resulting in increased privileges for their children have cured the difficulty.

In treating cases of this type a careful examination of the child's circumstances is necessary. If deprivation is suspected, an attempt must be made to locate its nature, and the first move in the curative treatment must be provision of opportunity for normal satisfaction.

Cases of Genuinely Excessive Endowment

Two instances of this type are the aggressive, domineering bully and the cruel child.

Occasionally the aggressive, overbearing child may be civilized by making him responsible for the welfare of particular younger children, or by giving him a measure of official leadership in some school activity. At the same time care must be taken that he does not use the position of authority in order to bully with greater impunity. The necessity for courtesy and consideration of the rights of others must be explained to him, and the fact that it is often easier to maintain one's legitimate authority by tact than by brute force. Also continuance in office must be made conditional upon reasonable self-restraint.

Some cases of cruelty to animals and other children arise from desire to find what will happen when something is tormented. Occasionally the undesirable investigatory tendencies may be connected up with a scientific interest in biology which provides opportunities for dissection under carefully controlled conditions.

In cases of excessive endowment, any attempt to repress the

energy represented by the undesirable tendency will only lead to more undesirable outlets, including deceit. Some kind of substitute-satisfaction which produces socially acceptable activities must be found. In this connexion choice of a career is important. Given the necessary physical and intellectual abilities, the overbearing boy may make a successful barrister or army officer; the girl with a desire to 'show off' may become a successful actress or dancer; the child who wants to look inside animals may make a good veterinary surgeon, and so on.

IV. Punishment and Penalties

There has been a good deal of confused thinking about the question of punishment. One is often tempted to lay violent hands upon an offending pupil and in a fit of anger, give him a sound thrashing on the spot. The teacher's anger is caused by an offended self-esteem. He is enraged at the idea that an inferior should have the audacity to flout his authority, and the chastisement satisfies his desire for revenge.

Again, the chastisement is intended to humiliate the pupil—"put him in his place," as it is expressed. If it does so, it produces resentment, a feeling of injustice, and a desire for revenge against the teacher. Or, it produces a sullen, stubborn resistance. In either case, the tendency for the pupil to repeat the bad conduct is intensified instead of being removed.

Hence there has been a strong reaction against the flogging traditions of former generations, both on psychological and humanitarian grounds. This reaction has been carried so far in some quarters as to lead to the condemnation of all penalties whatsoever. This attitude seems clearly to be mistaken and it is desirable to distinguish between *punishment*, which carries traditional associations of vindictive chastisement and repression, and *penalties* which are the natural inevitable consequences of wrong-doing or unwisdom. Both in a physical and social environment penalties are inseparably connected, by the nature of things, with error, in the relation of effect and cause, and the penalties imposed by the nature of the environment cannot be avoided.

It is necessary in the best interests of the children to make this fact quite clear to them. Otherwise, through carelessness and lack of anticipation they may do themselves irreparable damage. Hence there is a strong case for the imposition of penalties for wrong-doing.

In many cases the penalties will follow without being imposed by the teachers, *e.g.*, lack of industry, procrastination, carelessness may lead to failure in a critical examination and a serious set-back to a career.

In imposing penalties, we should carefully consider the following rules:

(*a*) The penalty should fit the crime, *i.e.*, should bear some rough proportion to the seriousness of the bad conduct, and it should, as far as possible, *be a consequence of the offence.*

(*b*) The connexion between the offence and the consequent penalty should be made quite clear to the offender. It does not follow that a connexion which is clear to an adult will also be clear to a younger person. The latter may persist in sitting on damp grass in spite of warnings. His penalty may be at best a cold or rheumatism, at worst an attack of pneumonia. The child, however, may not realize the relation between cause and consequence, and in that case the penalty, however severe it may be, will not deter him from repeating the unwise act on a subsequent occasion.

The advantage over punishment of penalties wisely administered lies in the fact that they are consequences of the act, and not arbitrary impositions given by persons. They have not therefore the same tendency to arouse resentment against persons. The sufferer can blame only himself for incurring the penalty. Moreover, it is clear to him that, if he dislikes the penalty, he can always avoid it by choosing the right conduct.

V. Social Discipline and Class-order

It is obvious that social discipline, properly so called, must not be confused with class-order. There has been a natural tendency in a school-system incorporating large classes, lack of apparatus, and no opportunities for free movement, to identify the two. The term 'good disciplinarian' has signified a teacher in whose class nobody moved or spoke except in obedience to a word of command.

Actually this condition does not necessarily represent any kind of true discipline. The acid test of good social discipline is made when the pupils are no longer under the immediate supervision of the teacher. Then, only too often the 'good' pupils of the 'good disciplinarian' immediately become young hooligans.

True discipline arises from within the personality. Then the rules are consciously imposed by each pupil upon himself independ-

ently of external supervision. True discipline can never be fully attained in a rigid dead-silent classroom. The environment must present some opportunities for freedom of action, and choice of alternatives. Habits of self-control and sound social judgment can only develop through practice in social adjustment.

This does not mean that there should be no class-order. Without good classroom-organization there cannot be efficient work. Moreover, the majority of pupils really prefer (although they may not publicly admit it) a reasonably systematic organization, to chaos. One of the first things the beginner at class-teaching must do is to organize systematic routine in the classroom. The really good disciplinarian, however, is the one whose organization is accepted and enjoyed by the pupils who identify themselves with it and *who maintain it while he is absent.*

VI. Moral Conduct and Moral Training

No specific mention has been made of moral conduct or moral training.

Moral conduct is social conduct directed towards ends which are judged by the community to have moral values. These values decide what conduct will be estimated by a particular social group as good or bad. The values are based upon ethical and religious grounds.

It is beyond the scope of this book to discuss morals and ethics. So far as teaching-method and school-organization are concerned the problem is one of training pupils in social adjustment. There are wide divergences of opinion even in a single political or economic group about the ends which social conduct *ought* to pursue. However, given certain ideals and values, and human pupils with their characteristic native endowments, then it is possible to indicate general rules for developing social conduct according to the particular moral ends accepted by the community as good. This aspect of the problem has been discussed in the present chapter.

However, while a discussion of moral values and ethical ideals is not possible or necessary here, yet a word or two about desirable *virtues* may profitably be added.

What constitutes a virtue in any community will depend upon the aims of the dominant section of that community. Implicit obedience to established authority will be counted as a virtue in a soldier or member of a religious order, but as a vice in a scientific

investigator. A critical attitude accompanied by intellectual honesty is an essential virtue in a political democracy, but it will be accounted a vice of the first magnitude in a dictator state.

In a modern democratic and progressive community the most important virtues would seem to be :

Intellectual Honesty

This involves a critical attitude, accurate knowledge, a high standard of truth, a desire for logically demonstrated principles, *tolerance of established fact,* and intolerance of prejudice, deceit, or any form of sham.

Loyalty to Principles

Courage

Without courage, intellectual honesty and enduring loyalty are impossible.

Toleration

This implies the acceptance with good humour of other people's personal idiosyncrasies. More unhappiness and harm are wrought by misguided persecution and tyranny than by any other single vice.

Temperance

True temperance implies doing nothing to extremes. It implies moderation in all things (including even physical training, work, and pleasure).

Exercises

1. Study a class of children and rank them in order of merit from the point of view of self-control. Note what factors appear to determine the control, *e.g.*, appreciation of right conduct, desire for social approval, fear, caution.

2. Collect a list of school-offences. Study the nature of each offence, and endeavour to diagnose its causes. What treatment is indicated ?

Apply certain lines of treatment to individual pupils—particularly to 'incorrigible' ones—and make careful observations and notes of the results.

Repeat these observations at different stages of school-life and compare the results.

3. Study a number of individual children and note the relation between intellectual ability, predominating motives (*e.g.*, hungers for excellence, for social approbation, etc.), temperamental and physical traits, and their social conduct in school and playground. Make a similar study of individual members of a family in the home conditions.

4. From such studies as 1, 2, and 3 above express a considered opinion on the assertion " To know all is to forgive all."

5. Make a study based upon practical acquaintance (*e.g.*, visits) as well as upon reading, of such institutions as a reformatory school, and a juvenile court. How far are the methods used based upon sound psychological principles ?

6. Make a study of a ' problem child.' Is the child a problem at home, at school, with one particular teacher, or generally ? What possibilities does this indicate ?

7. Draw out a schedule which could be used for rating the characters and temperaments of a number of children or adults.

8. Organize a scheme of pupil self-government in connexion with a school or club. Note carefully the difficulties and the essential conditions for success.

9. Analyse the feeling of guilt. What are its psychological elements ? What part does it play in social regulation ?

10. Trace in detail the growth and constitution of a sentiment in some particular individual, preferably yourself.

Books for Further Reference

ADAMSON : *The Individual and The Environment.*
BURT : *The Young Delinquent.*
GINSBERG : *The Psychology of Society.*
MCDOUGALL : *Social Psychology.*
MACKENZIE : *Manual of Ethics.*
O'SHEA : *Education as Adjustment.*
DEWEY : *Democracy and Education.*
NEILL : *The Problem Child.*
,, *The Problem Parent.*
,, *That Dreadful School.*
PHILLIPS : *The Education of the Emotions.*
SHAND : *Foundations of Character.*
THOULESS : *Social Psychology.*
ROSS : *Social Psychology.*

ROBACK: *Psychology of Character.*
WALLACE: *The Great Society.*
,, *Our Social Heritage.*
TROTTER: *Instincts of the Herd.*
PIAGET: *The Moral Judgment of the Child.*
SIMPSON: *Sane Schooling.*
CATTELL: *Your Mind and Mine.*
,, *A Guide to Mental Testing.*
NORWOOD: *The English Tradition in Education.*
WHITE: *The New Propaganda.*

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